# SCIENTIFIC AMERICAN

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## THE JETTIES AT GALVESTON HARBOR.

BY WALFRED WILSON.

There are four places on the Gulf coast of Texas that have each been trying for years to be designated as the harbor of the Gulf, by acquiring and maintaining deep water at their ports. For but one of the places, however, has the United States appropriated a sufficient sum of money to build jetties long enough to extend beyond the outer bar, that the action of the tide flowing in and out through the jetties may wash away this bar of sand and thus maintain a sufficient depth of water to admit the entrance of the largest vessels afloat. This place is Galveston, for which the government has appropriated $7,000,000, made a contract with J. H. O'Conner and E. H. Smoot, of Dallas, Texas, and the work is now being pushed to completion as fast as money and labor can push it.

The obstructions to deep water navigation at the harbor of Galveston have been the outer and inner bars. On the former the natural depth was 12 feet and on the latter about 13 feet, both at mean low tide. The present project for the improvement at this locality was adopted in 1874, modified in 1880 and again modified in 1886, the object being to deepen the channel so as to admit seagoing vessels of the deepest draught. The projects prior to 1874 related to dredging operations on a small scale only. The projects of 1874 and 1880 contemplated the constructing of two jetties to extend into the Gulf of Mexico, to concentrate the ebb flow upon the outer bar in the Gulf, and also effect deepening on the inner bar at the entrance to Galveston channel, these jetties to have their origins respectively at Boliver Point and Fort Point. The project of 1874 was with a view of obtaining a depth of 18 feet. More or less work was done under these pro-

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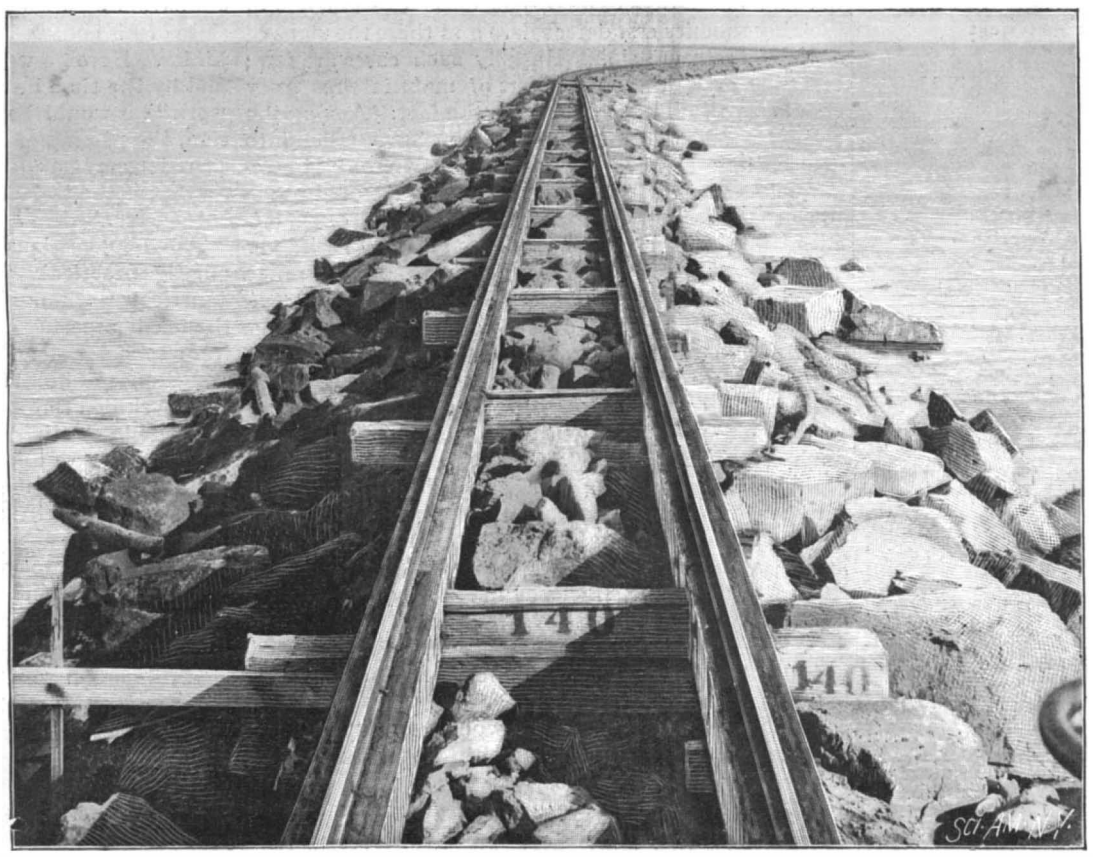
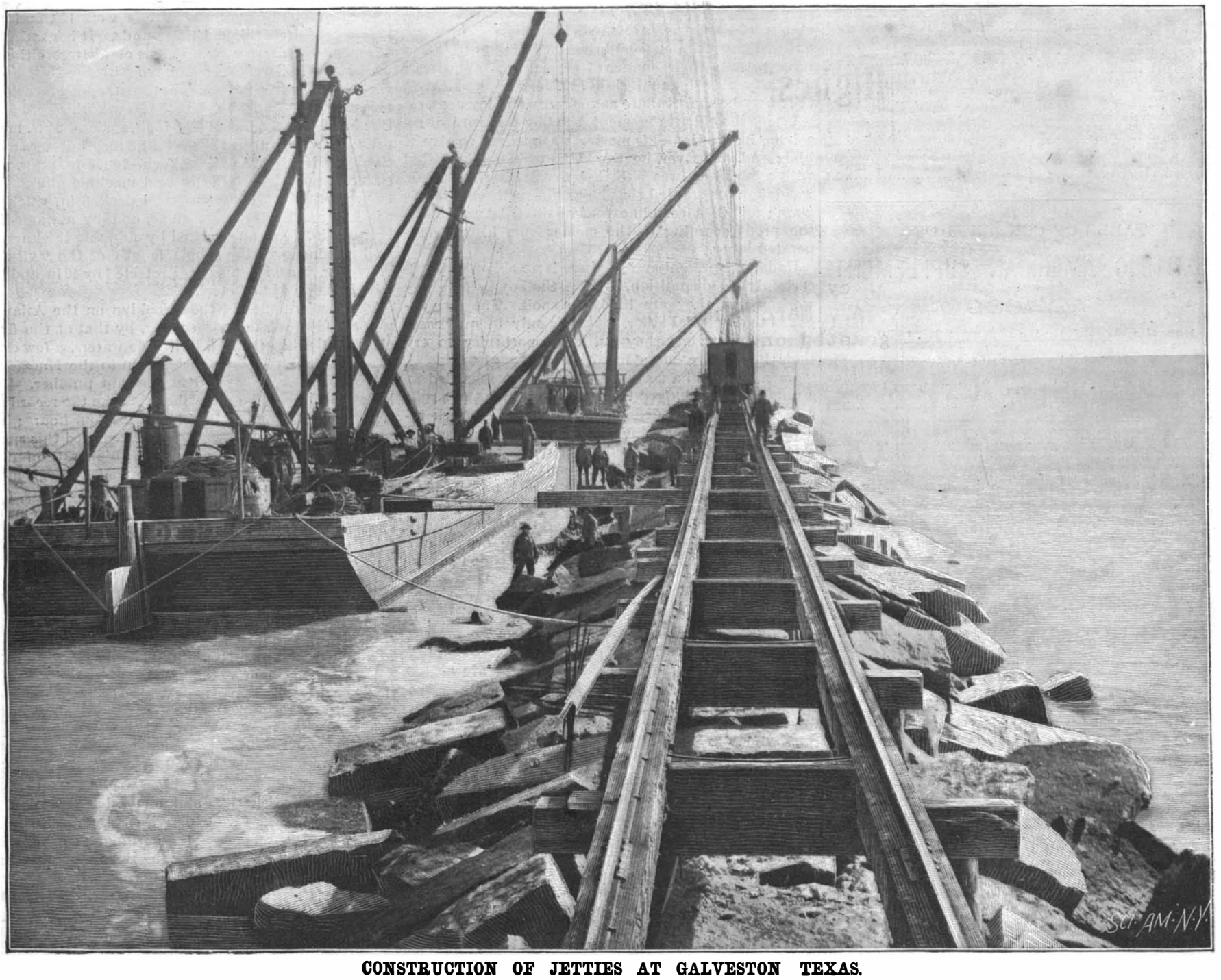


THE GALVESTON JETTIES—LOOKING TOWARD LAND.



CONSTRUCTION OF JETTIES AT GALVESTON TEXAS.

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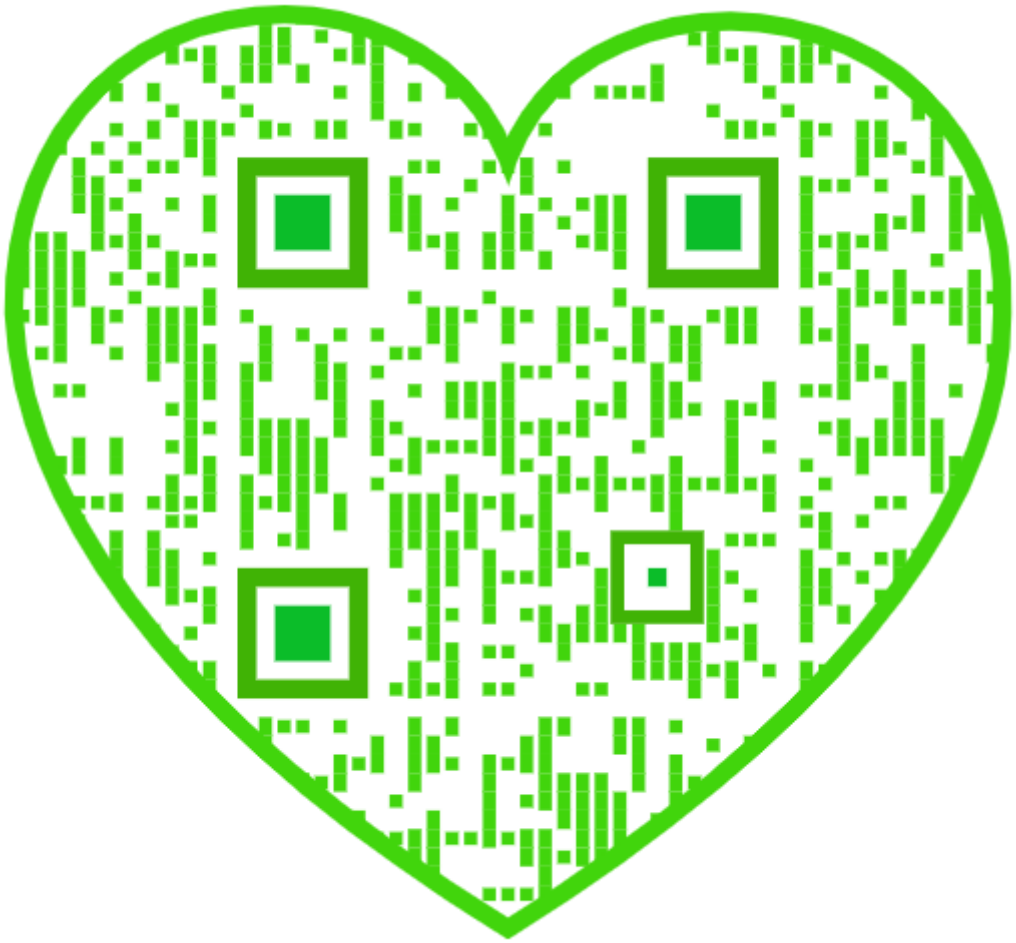

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## THE DECADENCE OF THE APPRENTICESHIP SYSTEM.

We, who are privileged to live in the closing years of the nineteenth century, are for ever telling ourselves what a magnificent age it is; and we never weary of hearing and repeating the count of our numbers, our wealth, and our wisdom. More often than not, this self-satisfied recital is rounded off with a contrast between what our forefathers were and what we have grown to be. In the main, the comparison is a just one, for as a matter of fact man, individually and collectively, is to-day better clothed, better fed, has more money in his pocket, and is cleaner in morals and person than he was fifty or one hundred years ago. In the midst of this general advance, and in some measure as the result of it, the student of social economics can detect here and there the signs of a decided retrogression. Happily such cases are few; but they exist, and no amount of material prosperity should be allowed to blind us to the fact. Among the many customs of our forefathers that have fallen into disuse, there are some whose lapse can only be regarded as a misfortune, and whose revival would prove to us that these customs were the outcome of experience, and that they were prompted by solid wisdom.

There was a time in this country when the entrance door into every trade was strictly guarded, and the boy who aspired to the dignity of being ranked as a journeyman carpenter, machinist, or builder could only hope to do so by becoming bound in an apprenticeship of greater or less duration. His instruction, which was carried out with the characteristic thoroughness of former days, commenced with the very alphabet of his trade; and each department was fully mastered before he was passed to the next. He attained at once manual dexterity and a knowledge of detail; and incidentally he acquired also a thorough respect for his trade, efficiency in which could only be gained after so many long years of training. At the close of his apprenticeship he was entitled to be called a skilled workman, and could command a journeyman's wages.

But to-day as the French would say, "we have changed all that." Apprenticeship is no longer the invariable rule—it is the rare exception. The careful, detailed instruction of the apprentice by the master mechanic has given place to a "hit-or-miss," "get-there" system, or, rather, lack of system, in which the boy's instruction is dependent upon the caprice of the journeymen whom he is told off to assist. In place of the regular day-by day instruction of the apprentice, who, by virtue of his articles of agreement, was entitled to continuous employment, the boys of to-day have to take their chance of picking up knowledge and acquiring manual skill at the odd times when they may be so fortunate as to secure employment.

Under the old arrangement, the boy was sure of receiving instruction—his master was pledged to give it him; and, moreover, he would be at times intrusted with a job which was a little beyond his powers. It was taken for granted that he would spoil some of his work; and to a certain extent he in this way offset the profit accruing to the master from his unremunerated labor.

Under the present system there is no obligation, and certainly no disposition, to give the boy helpers any work which they are likely to spoil. They are engaged to do menial labor, and it is only in rare cases of emergency that they get an opportunity to try their hand at a more important class of work. A "green" hand in a machine shop is never regarded as a pupil. He is judged from the standpoint of profit making, and the tendency is to keep him at work indefinitely at the machine with which he is familiar. The apprentice was moved from drilling machine to shaper; from shaper to lathe; from lathe to vise; and by this varied experience he acquired an all round knowledge and efficiency. But the specialization of work in these days has limited the range of a boy's opportunities to such an extent that he can never hope to gain much knowledge or execution outside the particular class of work to which he is assigned.

It must be admitted, however, that excellent as were the results under the old apprenticeship system, it would be impossible to carry it out under the present industrial conditions. The apprentice was "bound" to his master, lived under his roof, and ate at his board. Modern social conditions and the modern temperament would not lend themselves to a compact in which the position of the boy was one of very pronounced servitude; and the keen competition in the various industries, the close margin upon which the master mechanic has to figure in competing for a share of the trade, the speed and thorough system which are necessary in a modern workshop, all render the careful training of green hands in the shops a practical impossibility. Neither the master mechanic nor the journeymen can spare the time for such personal oversight; and work which has been contracted for upon the smallest margin of profit cannot be trusted to the clumsy, if willing, hands of a beginner.

But if the old system, good as it was, is impracticable to-day, and the methods of to-day are so faulty, what, it will be asked, is to be the remedy? We think that it will be found in an arrangement which shall embody the best features of both systems, and which shall be supplemented by that admirable institution known as the trade school.

The idea of oversight was an excellent one; and, so far as it can be exercised without interference with shop routine, it should be encouraged—at the same time the term of service should be very much reduced, and the relation of the boys to the master mechanic rendered more elastic.

The National Association of Builders has recommended that a lad who wished to enter a trade should go first to a trade school, and discover in which direction his tastes and aptitude lay. After passing an examination by a committee of master mechanics at the close of his course, he should enter the workshop as a junior. Here he would acquire speed and execution, and by the time he was capable of doing a "full day's work" he would be subjected to a second examination, the passing of which entitled him to be ranked as a journeyman. "Proof of ability, not length of service, is the test of what constitutes a mechanic in this system."

These suggestions are excellent, and they are thoroughly practical. The hope for the future of the American workman lies in the hearty co-operation of the master mechanics and the journeymen with the trade school system. If the American boy is to have any chance of holding his own against the incoming tide of skilled foreign labor, some radical change must be made in existing conditions. As we have shown, it is now well nigh impossible for him to attain the all round efficiency which marks the foreign journeyman, and enables him to secure work almost at the first application. If the master mechanics would follow some such scheme as was outlined by the national association, the inefficient, or, as he is expressively known, the "botch" workman, would cease to exist.

## THE SPEED TRIALS OF THE BROOKLYN AND THE OREGON.

During the past week two notable ships of the new navy have had their speed trials, and in each case the contract requirements have been exceeded by over a knot an hour. On May 11, the Brooklyn, an improved and enlarged New York, during a builders' trial of three hours duration, using forced draught, maintained an average speed of 21·07 knots an hour, which is 1·07 knots above the contract speed. The average revolutions of the screws were 132, and the steam pressure averaged 155 pounds. It is gratifying to learn that there were no signs of distress either in engines or boilers. As compared with the New York, the Brooklyn is of 670 tons greater displacement, measuring 9,150 tons against the New York's 8,480 tons. She is 400 ft. long, has 64 ft. 8 in. beam, and 24 ft. mean draught. She is armed with eight 8 in. guns—two more than carried by the New York—ten 5 in. guns, and sixteen 6 pounder rapid-fire and machine guns. She is protected by a complete steel deck, 3 in. thick on the flat, and 6 in. on the slope, and by a water-line belt of 3 in. steel plate backed by a double thickness of hull plating over the whole length of the "vitals." Moreover, the 8 in. guns are protected by 10 in. and the 5 in. guns by 4 in. of steel.

The performance of the Brooklyn on the Atlantic was excelled, relatively speaking, by that of the first-class battle ship Oregon, in Pacific waters, a few days later. The Oregon is a sister ship to the Massachusetts, which we illustrated in a recent number. The latter ship, it will be remembered, broke the record for her class by steaming 16·15 knots for four hours; but on Thursday, May 14, the Oregon exceeded this speed by $\frac{68}{100}$ of a knot, maintaining the high rate of 16·78 knots on a four hours' continuous trial. This is more than 1¾ knots above the contract requirements, and unless there are tidal deductions to be made from her speed, she will earn a bonus of $175,000 for her builders, the Union Iron Works, of San Francisco.

### Platino-Cyanids.

Arnulf Schertel describes, in the last Berichte, a new method of preparing platino-cyanids. Platinum chlorid is precipitated by hydrogen sulfid at 60° to 70° and the well washed platinum sulfid is dissolved in a warm solution of potassium cyanid. On evaporation the potassium platino-cyanid, $K_2Pt(CN)_4$, $3H_2O$, crystallizes out, and equal parts of potassium sulfid and potassium thiocyanate remain in the mother liquor. If a solution of barium cyanid is used, the barium platino-cyanid is obtained. With commercial potassium cyanid containing large quantities of sodium cyanid, Schertel obtained the beautiful double salt $KNaPt(CN)_4$, $3H_2O$, described by Martius. In view of the fluorescence of the barium and other salts of the platino-cyanids under the Roentgen rays, this simple method of preparation is of considerable interest.—Science.

AT a recent meeting of the Paris Academy of Sciences M. Balland presented a memoir describing an analysis of a sample of rice over a century old. He found the rice only slightly deficient in fat.

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### Intensifying Platinotype Prints.

BY E. J. WALL, F.R.P.S.

The following notes upon this subject are written in response to a question addressed to the "Consulting Room," but to answer thoroughly there would take up too much space.

Platinum is one of the most intractable of metals, and cannot, therefore, be converted into any form suitable for redevelopment without partially or entirely destroying the paper support. There are three distinct methods of intensification, not counting the so-called toning processes with uranium and iron and Packham's organic solutions, all of which, though described as toning, are really intensification processes.

Silver Intensification.—The most satisfactory formula for this is an acid hydroquinone solution:

| | |
|---|---|
| 1. Hydroquinone | 2 grains. |
| Citric acid | 20 " |
| Distilled water | 1 ounce. |
| 2. Silver nitrate | 48 grains. |
| Distilled water | 1 ounce. |

The prints, after development and clearing, must be thoroughly freed from acid and placed in a clean dish, a porcelain or glass dish for preference. Add 10 drops of No. 2 to 1 ounce of No. 1, and the solution, which immediately turns white and cloudy, should be well stirred and immediately applied to the wetted print and the dish rocked. Gradually the solution will begin to turn dark and dirty, but before this stage is reached the print will be seen to gain considerably in depth, and, when the desired intensity is reached, the solution should be poured off, the print thoroughly washed and fixed in hypo, and again well washed and dried. The image now consists partly of platinum and partly of silver. By treatment with a platinum toning bath such as—

| | |
|---|---|
| Chloro-platinite of potash | 1 grain. |
| Citric acid | 20 grains. |
| Salt | 10 " |
| Water | 2 ounces. |

the silver may be replaced by platinum, the result being almost a pure platinum image. Or, if slightly bluish tones are preferred, then the ordinary sulphocyanide gold bath may be used instead of the above platinum bath.

Platinum Intensification.—Dr. E. Vogel suggested the use of a very weak ferrous-oxalate developer, to which some platinum salt was added, but in my hands this is comparatively a failure. Miethe's process is rather more satisfactory, but is liable to give coarse granular images, and it is somewhat difficult to keep the whites pure. The print, after development and before clearing, is placed in a clean dish, and flooded with as little of the following as will cover it:

| | |
|---|---|
| Solution of neutral oxalate of potash | 1 ounce. |
| " sulphate of iron | 90 minims. |
| " potassium bromide (10 per cent) | 90 minims. |

The first two solutions are those used for ordinary ferrous-oxalate development. When sufficiently intensified it must be treated with acid as usual.

A much more satisfactory intensifier is that suggested by Hubl:

| | |
|---|---|
| 1. Sodium formate | 48 grains. |
| Distilled water | 1 ounce. |
| 2. Platinum perchloride | 10 grains. |
| Distilled water | 1 ounce. |

For use add to 1 ounce of water 15 drops of No. 1 and 15 drops of No. 2. The well washed print should be placed in a clean dish and flooded with this solution, and intensification will be complete in about fifteen minutes, when the print should be well washed and dried. Prints which have been dried take much longer to intensify by this method than those just developed.

Sodium formate is not in general use, but can be obtained by any dealer to order, as it is a well known salt. It must be noted that platinum perchloride—known also as platinum bichloride or platinic chloride, not the potassium chloro-platinite—must be used.

Gold Intensification.—The following process suggested by Dollond is very satisfactory. The well-washed print should be soaked in water, laid on a sheet of glass face upward, and excess of water removed by clean blotting paper. Pure glycerine should now be spread all over the print with the finger or a soft camel-hair brush. Now take a solution of chloride of gold one grain to the half drachm of water; add chalk to neutralize; filter, and then add one drop of strong hydrochloric acid. Drop about ten drops of this on to the print, and distribute at once all over with a camel-hair brush, and keep on brushing the print, which will gradually intensify. When sufficiently strong, rinse quickly and well, and sponge back and front of print with equal parts of the following:

| | |
|---|---|
| 1. Metol | 50 grains. |
| Sodium sulphite | 1 ounce. |
| Water | 10 ounces. |
| 2. Potassium carbonate | 1 ounce. |
| Distilled water to | 10 ounces. |

Then wash the print for half an hour and dry.

The rationale of all these processes is very simple. The intensifying metal, silver, gold, or platinum, is mixed with a reducing agent which gradually reduces the salt to the metallic state; but before there is any actual separation the metallic platinum of the image attracts the intensifying metal while it is in statu nascendi—that is, in the process of formation. This is entirely analogous to the development of a wet collodion plate, and is called physical intensification.—Photographic News.

### Artificial Flight Successfully Achieved by Prof. Langley's Aerodrome.

Artificial flight, corresponding very closely to the soaring of birds, has been at last successfully accomplished, and this, not merely for a short spurt down a hillside or along the level, but for a distance of half a mile, during a part of which distance the machine was actually soaring upward against the pull of gravitation.

The aeronautical world in general will be gratified that the first really practical solution of the problem should have been made by Prof. Langley. There is no experimentalist in this field of science who has labored harder to solve its problems than the secretary of the Smithsonian Institution; and it is noteworthy that the solution of mechanical flight should have been found in the direction in which his efforts have been persistently applied.

Prof. Alexander Bell, who was associated with Prof. Langley in the test recently made public, describes the successful experiments, which were carried out near Occoquan, Va., on May 6, as follows:

"Last Wednesday, May 6, I witnessed a very remarkable experiment with Prof. Langley's aerodrome on the Potomac River. Indeed, it seemed to me that the experiment was of such historical importance that it should be made public.

"I should not feel at liberty to give an account of all the details, but the main facts I have Prof. Langley's consent for giving you, and they are as follows:

"The aerodrome, or 'flying machine,' in question was of steel, driven by a steam engine. It resembled an enormous bird, soaring in the air with extreme regularity in large curves, sweeping steadily upward in a spiral path, the spirals with a diameter of perhaps 100 yards, until it reached a height of about 100 feet in the air, at the end of a course of about a half mile, when the steam gave out and the propellers which had moved it stopped.

"Then, to my further surprise, the whole, instead of tumbling down, settled as slowly and gracefully as it is possible for any bird to do, touched the water without any damage and was immediately picked out and ready to be tried again.

"A second trial was like the first, except that the machine went in a different direction, moving in one continuous gentle ascent as it swung around in circles like a great soaring bird. At one time it seemed to be in danger, as its course carried it over a neighboring wooded promontory, but apprehension was immediately allayed as it passed twenty-five or thirty feet above the tops of the highest trees there, and, ascending still further, its steam finally gave out again, and it settled into the waters of the river, not quite a quarter of a mile from the point at which it arose.

"No one could have witnessed these experiments without being convinced that the practicability of mechanical flight had been demonstrated.

"ALEXANDER GRAHAM BELL."

PROF. LANGLEY'S EXPLANATION.

Prof. Langley also made public a supplemental statement, giving some important data regarding recent experiments. It is as follows:

"The aerodrome, or flying machine, has no gas to lift it, as in the case of a balloon, but, on the contrary, is about 1,000 times heavier, bulk for bulk, than the air on which it is made to run and which sustains it somewhat in the way in which thin ice supports a swift skater.

"The power is derived from a steam engine through the means of propellers, but owing to the scale on which the actual aerodrome is built, there has been no condensing apparatus to use the water over and over. Enough can be carried for only a very brief flight, a difficulty which does not belong to larger machines than the present example, in which the supporting surfaces are but about fourteen feet from tip to tip.

"The distance flown each time was about one-half mile. The rate of speed depends (as in the case of any vehicle on land) on whether it is going on a level or uphill. In the case of this last trial of May 6 the machine was ascending, that is to say, it was going uphill all the time, and went through a distance of one-half mile or more in one and one-half minutes, or at the rate of a little more than twenty miles an hour."

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AT the last session of the Illinois legislature an appropriation was made for the erection and equipment of an observatory for the State University at Champaign. The contract for the instrument equipment includes a 12 inch equatorial, a 3 inch combined transit and zenith telescope and a chronograph. The optical parts by Brashear, the fittings, etc., by Warner & Swasey. Prof. Ira O. Baker will be in charge of the observatory.

### Science Notes.

Acetylene gas is attracting considerable attention in the north of Italy and we have received a copy of a new journal devoted to it, L'Acetilene e le sue Applicazioni, published in Milan. So far as we know this is the only paper given up to the new illuminant. One of the illustrations, which is credited as an American invention, is a lamp post in the base of which is a cylinder of liquefied acetylene gas. When the cost of the gas shall be materially lessened, some such scheme would furnish an ideal light for the grounds of country residences.

At a recent meeting of the Meteorological Society, Mr. W. Ellis, F.R.S., read a paper on the "Mean Amount of Cloud on Each Day of the Year at Greenwich for Fifty Years, up to 1890," from which it appeared that a principal maximum occurs in winter and a principal minimum in autumn, with a secondary much less pronounced maximum in summer, and a secondary minimum in spring. Cloudless days are most numerous in spring and autumn, and least numerous in winter and summer. Days of "much cloud" are nearly equal in amount in all parts of the year.

Lecturing at the Institution of Civil Engineers on atmospheric dust, Mr. Fridlander said that observations show that at an elevation of 6,700 feet there are 950 dust particles in a cubic centimeter, while at 8,400 feet there are only 513, and at 13,600 only 157 dust particles. Over the Indian Ocean the average number of dust particles a cubic centimeter was less than 500 for seven out of nine days, and on five days was less than 400. During a thick fog in the Atlantic, the air contained 3,120 dust particles a cubic centimeter, while in the clear region just beyond the fog there were only 280 dust particles.

As to the nature of the poison engendered by fatigue, some recent experiments have been made that are replete with interest. Maggiori and Mosso, as well as Wedensky and others, find that if the blood of a fatigued animal be injected into another animal that is fresh and unfatigued, all the phenomena of fatigue will be produced. Wedensky has made a chemical analysis, and finds the poison to be similar to the vegetable poison curare, into which the Indians used to dip their arrows, and a most deadly poison it proved to be. The poison engendered by fatigue is of the same chemical nature, and is as truly a deadly poison. In case it is created more rapidly than can be carried off by the blood, the organism suffers seriously.

A new prize has just been added to the long list of those awarded by the Paris Academy of Medicine. The prize is of the value of 24,000 francs ($4,800), the interest on a capital sum of 800.000 francs ($160,000), bequeathed by Mdme. Audiffred for the purpose. It is to be called the "Francois Joseph Audiffred Prize," and is to be awarded to any person, of whatever nationality and of whatever profession, who shall within twenty-five years from January, 28, 1896, discover a remedy, curative or preventive, recognized by the Academy as efficacious and specific for tuberculosis. In the meantime, the interest accruing from the bequest is to belong to the Academy, and can be applied in any way which that body may think proper.

As the result of his prolonged study of those striking phenomena, the thunder storms of Madras, Prof. Smith informs the Scottish Meteorological Society that the first remarkable fact observed by him was that of certain seasons of the year when sheet lightning appeared almost every night, always in a west or southwesterly direction, and invariably near the horizon; it may be, therefore, he remarks, that these discharges occur in the region where the moist and dustless sea winds meet the dry and dusty land wind, one being, perhaps, positively electrified and the other negatively. In these lightning displays, as many as three hundred flashes per minute have been counted, this rate being kept up for an hour or an hour and a half. Another notable peculiarity remarked of this region is that the heaviest rains are unaccompanied by thunder, while the displays of lightning are not accompanied by any rain.

H. M. Bernard has been engaged for the past ten years in endeavoring to find an explanation of light sensations, and has at last worked out a theory which he considers capable of connecting and explaining most of the phenomena. He hopes also to prove that it is capable of demonstration, and is now engaged in arranging the evidence. Meanwhile, a short abstract is published of the conclusions arrived at, the development of visual organs in the animal kingdom being briefly described as follows: Under the influence of light certain organisms traveling toward the light seek either to leave the Metazoan body altogether or else to discharge their contents at the surface. Such emigration cannot take place without the cognizance of the nervous system, and in the most frequently illuminated parts of the body complications arise between the fugitives and the other tissues, notably the peripheral nerves. Bernard's suggestion, says the Magazine of Natural History, is that out of these complications all the known eyes of the animal kingdom, the most complicated as well as the most simple, have arisen in one way or another.

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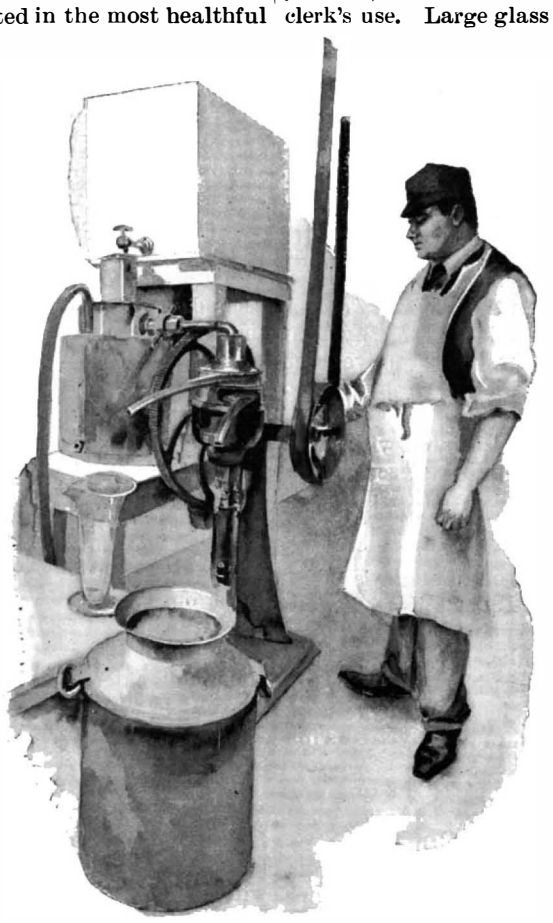
## MODIFIED MILK.

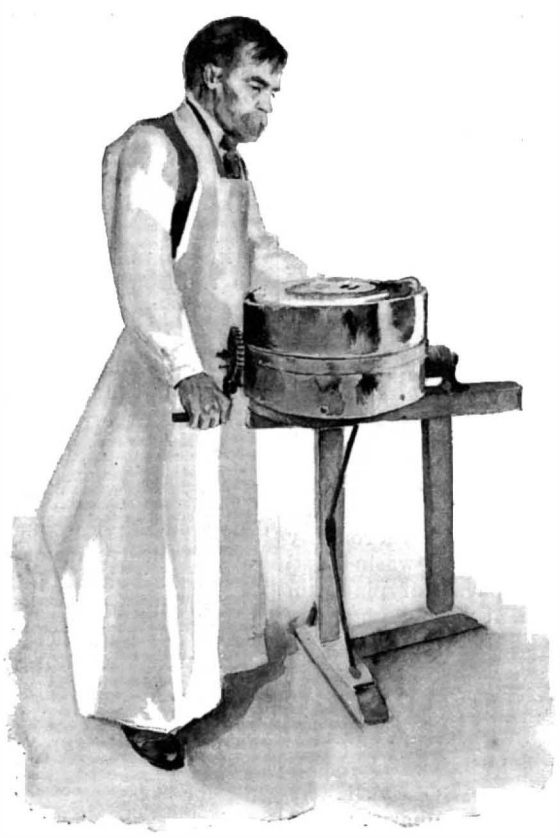
The result of scientific experiment with milk as a food is the successful establishment of laboratories for its modification. The first laboratory for this purpose that has been established in the world was opened in Boston in 1891. There is another now in New York City and a third in Philadelphia, while others are to be opened in several Western cities.

These laboratories are situated in the most healthful localities, as milk is one of the best mediums for the cultivation of bacteria, and are scientifically conducted by men whose knowledge of the subject has enabled them to carry on the work with great success. Every precaution is, therefore, taken for cleanliness and against contaminating influences of any kind.

The interiors are especially arranged that everything may be kept entirely free from dirt or dust. The walls of the rooms where the work is done are of white tiles and the ceilings of material that may be washed and scoured, while the floors are of waterproof asphalt, sloping slightly to the center of the room, so that the water, with which everything is daily drenched, may drain away. In every room a large automatic fan causes the floating particles of dust or any insects to be carried away through large pipes, thus increasing the general cleanliness. Every department of the work has its special room, and various machines for different purposes occupy spaces in the rooms where they are used.



THE CENTRIFUGAL MACHINE.



THE FAT TESTER.

Modified milk is particularly a food for infants and children and has proved a most material aid to physicians, and by saving many lives a great benefit to humanity.

The peculiar process of milk modification is most interesting.

The milk used in this work is supplied by a herd of cows carefully selected and cared for, and is received in large glass jars at the laboratory shortly after milking. These cows have the tuberculin test applied to them every six months by the State, or any other competent veterinarian, as a guard against transmitting tuberculosis.

When received it has a temperature of about 40° Fah., having been kept cool by ice during transportation. It is immediately put into tanks of iced water, in the milk room, so that the same temperature may be maintained.

THE WATER STILL.

This prevents the growth of bacteria. Here it is kept until it is ready to be used, when it is taken to the separating room, where, by the use of a centrifugal separator, the cream is separated from the milk. This machine is one of great delicacy and speed, revolving at the rate of six thousand eight hundred times per minute, and works with such effect that only a small percentage of fat, 0·02 per cent, remains in the milk. The usefulness of this machine is not alone in the withdrawal of the fat from the milk; by its great force it separates dirt and other foreign matter common to milk, from the cream and milk, leaving them as nearly clean as they can be. The cream which is separated is about 30 per cent fat. It is reduced to 16 per cent, which is the stable cream for the modifying clerk's use. Large glass jars are filled with the separated cream and milk, and kept at 40° Fah. temperature, to prevent the growth of bacteria, as milk that is modified from materials free from bacteria is better for the infant than milk in which the bacteria have been destroyed by heat.

This is then ready for the modifying clerk's use, and when desired is taken to the modifying room. The modifying clerk tests the milk each day in order to ascertain the percentage of fat, as it is liable to differ from day to day, as the percentage in different cows changes, and therefore slightly affects the whole. This test is made with the aid of a machine called the Babcock milk tester. It is a centrifugal machine, into which bottles containing acidified milk are placed, and the fat is made to separate quickly and completely by rapid revolution.

The milk is acidified in order that the proteids, casein, and fibrin may be changed to soluble acid, albumens, which offer less resistance to the rising and aggregation of the fat globules. Nearly equal volumes of milk and commercial sulphuric acid of 1·82 specific gravity are put into test bottles having long graduated necks.

MODIFYING MILK.

These bottles are then put into the centrifugal machine and caused to revolve rapidly for several moments, when they are taken out and filled to the neck with hot water, and returned to their places to be whirled one or two minutes longer. After this they are filled with more hot water, to about the 7 per cent mark, and again turned for a short time, when the fat separates and its percentage is easily noted on the graduated neck of the bottle.

When the modifying clerk is ready to modify the milk, he has before him several pitchers of fluids, arranged in regular order, so that he may readily use whichever one he may need at the moment.

The first contains an amount of the stable cream, procured from the separator, which is used to obtain the prescribed percentage of fat. A second pitcher holds the separated milk, which he uses to gain the different percentages of proteids which the physician's prescription demands. Another is a carefully prepared 20 per cent solution of milk sugar dissolved in distilled water. This is to make up the amount of sugar called for in the prescription.

A fourth pitcher holds a quantity of lime water by means of which the reaction of the food is adjusted.

Distilled water is in another pitcher and is got from a still which stands at one side of the room.

Other vessels contain preparations of oats, barley and wheat, which are added to the milk to be used by infants old enough to have starch in their food.

From these fluids he makes up the prescription, measuring into a large graduate glass the exact number of ounces of each called for, and pouring the whole into a pitcher, which he passes to a second clerk. The milk is thus recombined with greater or less percentages of its parts, or constituents, as may be stated in the medical prescription.

The second clerk pours the modified milk into glass tubes devised especially for use as nursing bottles and for transportation, measuring into each tube the number of ounces prescribed to be given at each feeding. When this is done the tubes of milk, which are held in light willow baskets of different sizes, or numbers of compartments, are passed to a second clerk who stopples them. Non-absorbent aseptic cotton is used for this purpose, a wad of which is forced into the neck of each tube and the refuse end cut off neatly with a pair of scissors, thus making a neat stopper. This having completed the modifying process, the sealed tubes in their baskets are taken to a room where there is a large heater, into which they are placed. This heater is so arranged that the steam passing through it can be regulated to produce any degree of heat required. This is accomplished by means of a regulator connected with the steam pipe. A clerk in charge uses this to keep the heat at some desired degree, which he is enabled to do by watching the thermometer which is fitted to the heater.

FILLING NURSING BOTTLES.

The milk is heated to one hundred and sixty-seven degrees when it is to be used within forty-eight hours. This destroys any ordinary bacteria common to milk, but does not cook the milk or coagulate the proteids,

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and is called "pasteurizing," from the eminent chemist Dr. Pasteur, who claimed this was a sufficient degree of heat for carefully prepared milk. But when the weather is very hot or the milk is to be sent great distances, such as across the continent, or to Europe, and is expected to keep for more than forty-eight hours in good condition, it is heated to 212° Fah., which sterilizes it. It has been found that to let it remain in the sterilizer forty minutes produces the best result. When taken from the sterilizer the baskets of milk are placed in cooling tanks, where the temperature is reduced to 38° Fah. The baskets are then placed in wagons and delivered to the consumers in a short time. The returned baskets and tubes are taken to the wash room where they are placed in a special sterilizer and then washed in a solution of soda and water, thus guarding against all possible infection. All tags and stopples that are returned are destroyed.

The work of modifying milk has thus by scientific means become a most important factor in medical knowledge, and of great benefit to all through its utility in promoting the health of children and saving the lives of many who, by improper nourishment, do not survive the early maladies common to children. The work which has been brought to so successful an issue is sure to grow, claiming for its promoters and originators the gratitude of many parents and the interest which the achievements of science have for most people.

APPLYING ANTISEPTIC STOPPERS.

### The Carbon Process: Combination Printing of Clouds, Backgrounds, etc.

BY W. ETHELBERT HENRY, C.E.

When a beginner first undertakes to tackle carbon printing, he finds his chief troubles arise from the fact of being unable to watch the formation of the image upon the black, leathery tissue.

So far as correct exposure is concerned, a photometer proves a ready and reliable means of registration, but when it comes to printing in clouds or figures from one negative, and a foreground or background from another, the beginner is apt to feel at a loss, simply because he is dealing with an invisible image.

There are several well known plans of securing accurate registration of several images upon carbon tissue, all differing more or less one from the other.

The method recommended by the Autotype Company is especially useful when one wishes to use part of the sky of a large negative upon a landscape print from a small one, but unfortunately their directions are hardly explicit enough for a novice. For instance, let us suppose that we have a half-plate negative, interesting in its main features, but devoid of sky; suppose, also, that we have a whole-plate negative containing suitable clouds that we wish to utilize by combining part of them upon the half-plate print.

To do this, we must cut a piece of white paper the size of the half-plate negative, and hold them together toward the light, so that we can distinctly see an outline of the horizon. This outline must be traced in blacklead pencil upon the paper.

We must next lay this tracing on a piece of yellow paper (such as thin canary medium—not fabric), and mark the outlines and the horizon line by going over them with a dull point; the outlines must be the exact size of the half-plate negative.

We must next place the glass side of the half-plate negative upon the film side of the whole-plate, until the sky part covers that part of the whole-plate sky we wish to use. When the correct position is determined (and great care must be taken to have the horizon line level), the negatives must be held firmly together, while a finely pointed crayon is passed over the film of the larger negative, as close to the edges of the smaller one as is possible. This is to mark the correct position upon the cloud negative, the crayon lines being easily rubbed off with a piece of flannel when we have finished with them.

We must next cut the yellow mask the exact size of the half-plate negative, and then divide it along the horizon mark into two pieces; before actually cutting it, it would be well to mark one side of the paper with two small crosses—one at the sky half and one below. This will render it an easier matter to avoid mistakes when fixing the masks in position. We will suppose that these crosses have been made upon the surface of the yellow mask while it is lying upon the film side of the half-plate negative in its correct position as regards the horizon and outlines.

Having now divided the mask into two parts, we must take the lower half and fix it (with its cross still in view) upon the lower part of the outlined space on the film side of the whole-plate negative; the crayon lines of the bottom and sides being the guides as to correct position. The best way to fasten the mask upon the negative is to give the former a dab of thick India rubber solution upon each lower corner; in a few seconds it will be dry enough to stick where it is pressed. I need hardly add that a light pull will suffice to remove the mask without injuring the negative.

We must next take the upper half of the mask and fix it upon the glass side of the half-plate negative, with its extreme outside edges in register with the outlines of the negative; in this case the mask (being upon the glass side of the negative) must be fitted with its cross in contact with the glass, and therefore out of sight.

We must now cut a piece of carbon tissue to the exact size of the half-plate negative, put a pencil mark upon the lower part, and expose it in contact with the half-plate negative for the necessary time; this must be done in diffused light, in order to avoid the outline that would inevitably be caused if exposed to the sun. The tissue must then be removed and placed within the crayon outline (and over the yellow mask) that marks its position upon the larger negative.

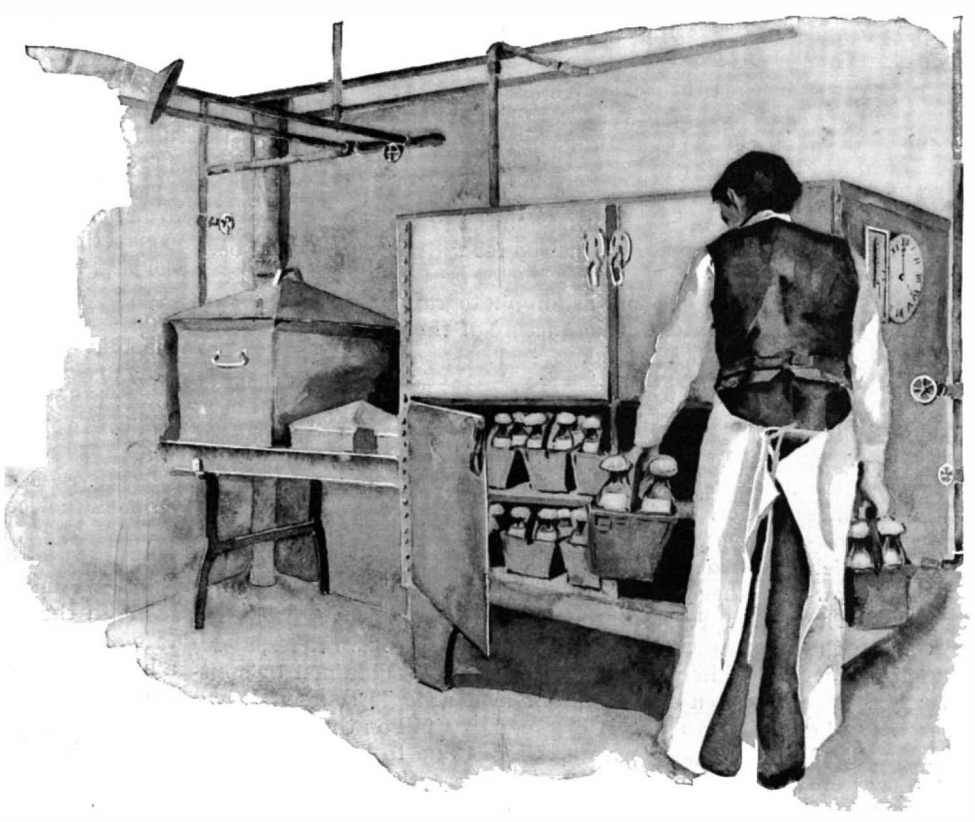
An exposure to light, more or less brief, must now follow, and in order to prevent a visible line of junction between the sky and foreground, we must move a sheet of cardboard over the horizon line during the whole time. To do this, the card is usually held in one hand and drawn downward until the horizon is just passed, and then slowly moved upward to the top, or nearly the top, of the sky. This up and down movement should be continued, more or less slower (according to the desired effect), so that the sky will be neatly graduated.

Of course, it is necessary to use a "safe edge," as in ordinary carbon work; the one on the large negative can be a temporary affair made with a few lantern slide binding strips fixed to the glass side.

Although the foregoing may seem rather an elaborate method, I can assure you that it is extremely simple in practice. As I am writing for beginners, I have necessarily described every minute detail—even as to which side of the negative is to be used. My long experience of beginners and their troubles has induced me to do this, as I know how difficult it is for them to follow the brief directions issued by manufacturers, who seem to take for granted that a beginner can divine by instinct a lot of details known to the writer of the "directions for use."

In order to combine a portrait from one negative with a background from another, we must employ a somewhat different method. First take a print from the portrait negative upon a sheet of printing out paper or albumen paper. The outline of the figure must then be carefully followed with a pair of sharp scissors so that we secure two masks, one of which fits accurately within the other. The two masks are then exposed to light until printed as dark as possible; the background part is then stuck (face down) over the film side of the portrait negative with extreme care, so that all, save the figure, is covered. The top edge of the carbon tissue is then smeared with thick rubber solution, so that it will adhere to the top edge of the mask; then the exposure is made for the necessary time.

After exposure, the negative and tissue are taken together (still in contact) from the printing frame, and a dab of thick rubber solution is put on the bottom (back) edge of the figure cut out. The carbon tissue is then gently raised from the bottom, without disturbing the top (adhering) edge, until the uncovered space of the negative is visible. The figure "cut-out" must now be carefully adjusted until it covers this space and fits the outer mask exactly; the carbon tissue is then gently lowered and firmly rubbed to make the figure "cut-out" adhere. The top edge of the carbon tissue must next be gently pulled from the negative, when the figure "cut-out" will be found covering that part that has just been printed. The tissue, with the adhering cut-out, is now adjusted over the background negative (in a space previously marked, if it is a larger one), and printed for the necessary time. The cut-out is then removed for future use, and development is conducted in the usual way.—The Amateur Photographer.



PASTEURIZING THE MILK.

### Curious Effect of Lightning on a Trolley Car.

A case is reported in New Brunswick, New Jersey, of a trolley car being struck by lightning on the afternoon of May 5, during a thunder storm. The electricity ran down the trolley pole and entered the car, part of the current running on to the lighting circuit, burning out the incandescent globes. So intense was the heat in the lamps that the glass globes melted; most of the glass fell on the floor, but other drops went into the laps of women and more fell on their hats. The ladies thought they had cause for complaint, and demanded that the officers of the company make good the damage to their garments. This singular instance of the effect of a sudden stroke of lightning makes it necessary for some new invention to be devised for the prevention of a similar disaster.

### Percentage of Moisture in Green Wood.

According to M. Deplay, green wood when cut down contains about 45 per cent of its weight in moisture. In the forests of Central Europe wood cut down in winter holds at the end of the following summer more than 40 per cent of water. Wood kept for several years in a dry place retains from 15 to 20 per cent of water. Wood which has been thoroughly desiccated will, when exposed to air under ordinary circumstances, absorb 5 per cent of water in the first three days, and will continue to absorb it until it reaches from 14 to 16 per cent as a normal standard. The amount fluctuates above and below this standard according to the state of the atmosphere. M. Violette found that by exposing green wood to a temperature of 212° F. it lost 45 per cent of its weight, which accords with observations of M. Deplay. He further found that by exposing small prisms of wood one-half inch square and eight inches long, cut out of billets that had been stored for two years, to the action of superheated steam for two hours, they lost from 15 to 45 per cent of their weight, according to the temperature of the steam, which varied from 257° F. to 437° F. (125° C. to 225° C.)

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### National Electrical Exposition Notes.

The second week of the exposition finds the whole exhibit in good working order, and the somewhat dim illumination of some of the side aisles, which was noticeable at the opening, has given place to a blaze of light which is fully up to the level of the rest of this excellent display. The great advance which has been made of late in the manufacture of arc lamps is evident from the perfect steadiness of the lighting; and the visitor is also struck with the endless variety of devices for softening and for diffusing the light. Incandescent lamps are shown in soft and pleasing colors, and the display of arc lamps proves how much can be done to render them beautiful, not merely in color, but in the shape of the globe and details of the fittings. The George A. Macbeth Company, of Pittsburg, Pa., exhibit some varieties of what they call the holophane, a glass globe which is cut into a series of concentric angles on its outside surface and on the inside is cut into radial angles. The light is caught and refracted by these angles until the whole surface is brilliantly aglow.

It is unfortunate that a larger percentage of the visitors do not inspect the light and power room on the first floor. It is now in full running order, and, as an exhibit of the best and latest practice, it is a valuable object lesson for the electrical engineer. The Siemens & Halske dynamo, with its outside armature, will attract attention. It is a 100 kilowatt machine, direct connected to a 150 horse power Ball & Wood engine. It is run at 250 revolutions, and the smoothness and silence of the running are remarkable. This engine is built with a telescopic valve, designed to take up the wear. A small model of the valve is shown and explained by the attendant.

Next to this stands a Phœnix horizontal tandem compound engine, direct connected to an 80 kilowatt Walker generator. The high pressure cylinder is in front and the low pressure cylinder is bolted to a subbase. The arrangement is compact and facilitates repairs.

What may be called the popular side of the exposition has been well provided for; and one of the most popular exhibits is that of the Practical Laboratory, which is under the supervision of Mr. Max Osterberg, of Columbia College. Practical demonstrations are made of the various principles of electricity. An arc light is seen burning under water, and this experiment is shown with the apparatus made by Prof. R. Ogden Doremus, of the College of the City of New York, Bellevue Hospital, and used by him in a lecture at the Academy of Music in 1856. The electrolysis of water and the electro-magnet are popularly explained, and a machine is seen in operation which illustrates the action of Fuco's currents.

On the same floor is an extensive exhibit of machines designed by Elihu Thomson, which has been brought over from the Thomson-Houston factory, Lynn, Mass. This contains, among other objects of interest, an oscillating type watt meter; the original welding transformer; a case of three dozen photographs of past and present transformers; and several examples of electric welds, including 3 feet of ¼ inch welded chain, there being two welds in every link, a welded band saw, and a plate iron lap riveted joint, in which the rivets are practically welded into place. There is also a fine exhibit of Mr. Thomson's arc lights of the original T D and K type, and of dynamos built in 1876 and 1878.

Before leaving this floor, a visit will be paid to the exhibit of the electrical wonder of the hour, the Roentgen X rays, which are shown by Mr. Edison by means of his fluorescent screen. The crowd of sightseers is passed in single file into a dark room, where the screen is arranged inside a railing, in much the same way as an ordinary ticket window. The crowd passes one by one, in front of the screen, which is about 18 inches square, and the hand is passed up within the screen and placed against it. The current from the powerful Ruhmkorff coil, of 25,000 volts, is turned on, and immediately the screen glows with a pale light, upon which is seen the ghostly shadow, or shadows, of the hand, the flesh showing up in faint shadow, the bones in darker shadow, and the ring, if one is worn, showing out in black. One must confess that a result which is merely interesting on paper becomes a little grewsome when seen through one's actual living flesh. The arrangements were so well carried out that, in the course of an hour, some four or five hundred persons must have taken a look at their anatomy.

On the main floor, the latest developments in the manufacture of wire and cable and various improved methods of insulation are shown at the two booths of the Safety Insulated Wire and Cable Company and the Washburn & Moen Manufacturing Company. A curiosity in the latter exhibit is a coil of copper wire which is 15½ miles long and weighs only a trifle over 2 pounds. The wire is $\frac{29}{10000}$ of an inch in diameter.

The John A. Roebling's Sons Company show a bimetallic wire—a steel core with a copper jacket—which combines the conductivity of copper with the strength of steel. A wire, $\frac{32}{100}$ of an inch in diameter, has a strength of 5,700 lb., and weighs 1,620 lb. per mile.

Across the way from these booths will be found a display by the Fort Wayne Electric Company. They show a single phase alternating current motor, of 10 horse power and 16,000 alternations; also a 5 horse power single phase alternating motor driving a 7 kilowatt bipolar 110 volt dynamo.

The attendance at the exposition has been very gratifying and is increasing.

### A NATURAL MOUSE TRAP.

Mr. W. H. Marris sends us the following curiosity, says the Amateur Photographer:

From time immemorial the mouse has been classed with the pests with which mankind has had to deal. The little animal has three leading and discreditable characteristics, i. e., thief, trespasser and destroyer of property. It is therefore not surprising that human ingenuity has been ever actively employed against the unwelcome creature's life.

Besides the chemist with his poisons, and the wood and wire workers with their clever devices, the mouse has had a natural foe in the cat; but notwithstanding all kinds of snares, mice are not yet exterminated. But since the creation there has surely not been known a more curious enemy to mice than the one that has recently distinguished itself at the fishing metropolis (Grimsby), on the night of March 28.

An oyster was on that day placed on a pantry floor, and during the night (feeling thirsty) it opened its shell. Three silly, wandering mice were near too, and smelling fish, all placed their heads just inside for a taste. This intrusion was instantly resented by the occupant of the shell, and hastily yet silently a relentless grab was made, and those foolish mice were suddenly executed prisoners.

Such a thing has been known on oyster boats here

OYSTER AND MICE.

as the capture of a single mouse by an oyster, and rats have suffered injuries to legs, etc., but the trapping of three mice simultaneously is a record for an oyster, which I think at present is acknowledged a unique feat.

Has the oyster firmly conspired to oust the cat from the legitimate occupation for which it has so long been renowned?

Thanks to the art of photography, our readers are able to see an exact picture of the captor and the captives just as found.

### New Method for Measurement of High Temperatures.

M. Daniel Berthelot has devised a plan for the measurement of high temperatures which depends on the refractive index of the heated gas. It has recently been ascertained that if you bring a given gas to a given density it will have the same refractive index whether you reach this result by varying the pressure or the temperature or both, says the Progressive Age. Consequently, M. D. Berthelot takes two tubes, along which he passes two beams of light obtained by splitting up a beam of light from a single source. When these two beams are made to fall on the same spot, they produce certain fringes, due to interference. If one of the tubes be heated, these fringes are displaced; but they can be brought back to their original position by varying the pressure in the colder tube. This alteration of pressure then produces exactly the same alteration of density in the colder tube as is effected by the heat in the hotter one; and this enables the temperature in the hotter tube to be calculated. After settling that this could be done, M. Berthelot proceeded to simplify the method by working with only one tube, filled with ordinary air; and he expects to be able to make the method one capable of being readily applied for manufacturing purposes.

### Notice.

A premium of $250 is offered by the SCIENTIFIC AMERICAN for the best essay on

THE PROGRESS OF INVENTION DURING THE PAST FIFTY YEARS.

This paper should not exceed in length 2,500 words.

The above-mentioned prize of $250 will be awarded for the best essay, and the prize paper will be published in the Special 50th Anniversary Number of the SCIENTIFIC AMERICAN of July 25. A selection of the five next best papers will be published in subsequent issues of the SCIENTIFIC AMERICAN SUPPLEMENT at our regular rates of compensation.

The papers will be submitted for adjudication to a select jury of three, to be named hereafter.

Rejected MSS. will be returned when accompanied by a stamped and addressed envelope.

Each paper should be signed by a fictitious name, and a card bearing the true name and the fictitious name of the author should accompany each paper, but in a separate sealed envelope.

All papers should be received at this office on or before June 20, 1896, addressed to

Editor of the SCIENTIFIC AMERICAN,
361 Broadway, New York.

## Correspondence.

### The New Hudson River Bridge.

To the Editor of the SCIENTIFIC AMERICAN:

Your beautiful illustration of the proposed new bridge over the Hudson River at New York, in the May 2 number, excites everywhere intense interest.

The central span, 3,254 feet, may, perhaps, be impossible to diminish, but the cost of the bridge itself, $25,000,000, could certainly be diminished one-half, for it is intended that there shall be six railroad tracks, and the bridge be strong and heavy enough to carry all the tracks, loaded with trains (including, of course, 100 ton locomotives) from end to end, or a total live load equivalent in weight to 30,000 tons.

May I not modestly suggest to the engineering fraternity that by limiting it to two tracks only (or four at most) with two or four cars to each train and no locomotives, the bridge would be perfectly capable of doing all the work and even more than the system as at present proposed, at the same time the cost could be diminished to within eight or ten millions, and make a much stronger and more beautiful structure.

Strickland Kneass, Esq., the engineer of the Pennsylvania Railroad some seven or eight years ago, deferred recommending such a structure to Thomas A. Scott, then president of the Pennsylvania Railroad Company, because his estimate of eight million dollars for the cost was too stupendous to undertake, and that included taking one hundred acres of the southerly end of Central Park for a grand international depot. HENRY DAY.

New York, May 8, 1896.

### Valuable Patents.

American inventors will have their ambition excited by the recent sale, by the Diamond Match Company, of Chicago, Illinois, of patent match making machinery and rights to European governments. That company received $600,000 from the French government and $800,000 from the Italian government, and it is reported that they will receive similar sums from Germany, Austria-Hungary and other countries, says the American Woodworker. Five years ago the science of converting logs into matches was said to be a finished science, incapable of further improvement, but American ingenuity has shown that what was "perfect work" in 1891 will not answer for 1896. Even now the machines used in making matches, wonderful though they are, are not to be left unchallenged, as inventors are working on new ones, whose capacity will, they claim, far excel that of the best machines now in operation. He is a bold, or a very ignorant, person who will in these days assert that any process, tool, machine or device is incapable of further improvement. There may be, there are, many absolute failures in the works of the inventors, but it is an open truth that there are many satisfactory successes also, and that through the labors of these ingenious persons everything in the shape of machines is gradually coming to a higher plane.

ON April 20 Senator Cannon introduced a joint resolution which if it is enacted into law would give the city of Washington a remarkable attraction. Mr. Cannon proposes to have constructed an enormous map of the United States showing every hill, mountain, valley, river, lake, village, city and railroad. All this is to be done in miniature, but on such a scale as will give a map about two-thirds of a mile in length by one-third of a mile in breadth. The map is to be constructed on such a scale that one foot of map surface would represent one square mile of the actual area. The proposition is a serious one, although it is not likely to be received as such. The value of such a map would be very great.

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## THE JETTIES AT GALVESTON HARBOR.

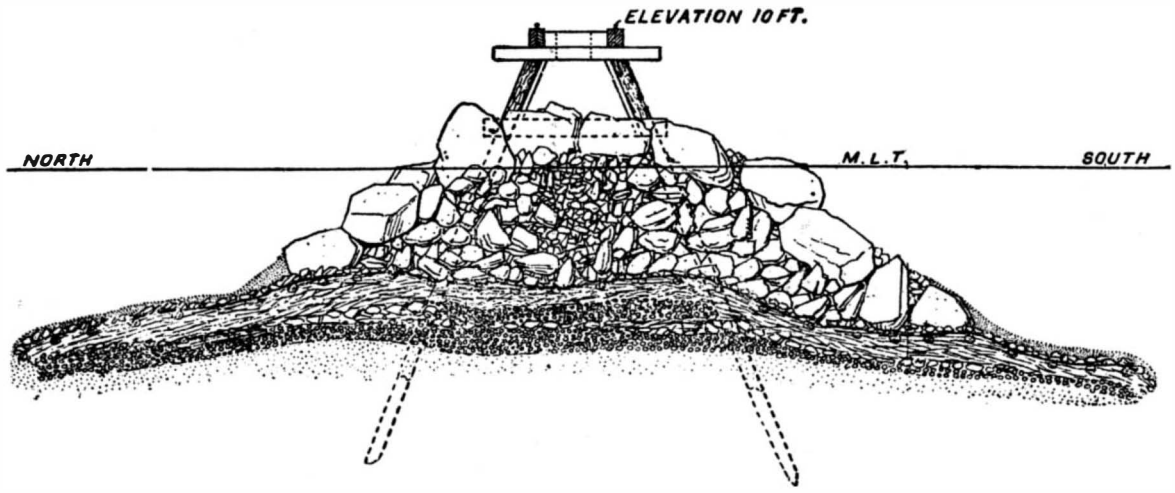
(Continued from first page.)

jects. Under that of 1880 a jetty was built from Fort Point, the east end of Galveston Island, to the crest of the outer bar, but it was not fully completed.

The modification of 1886 (now in progress of execution) was with a view to a possible depth of 30 feet, by means of jetties, to be supplemented, if need be, by dredging. These jetties were to be of rock and to be built to a height of 5 feet above mean low tide, extending if necessary to the contour of the 30 foot depth in the Gulf, their sea ends to be 7,000 feet apart, and the south jetty to follow the line of the jetty of 1881. But it was decided to connect the inner end of that jetty with the relatively high ground upon which the city of Galveston is built by a stone dike known as the shore branch.

The cost of the modification of 1886 (the present project) was estimated at $7.000,000. The total amount expended under the foregoing plans to December 12, 1895, was $4,846,105.08, in addition to which there was expended $100,000 subscribed by the city of Galveston in 1883. The total work done since operations began in 1887 is represented by 33,820 feet of south jetty, of which 32,000 feet is completed, and 23,600 feet of north jetty, of which 21,200 feet is completed. Both jetties are beyond the bar, in about 23 feet of water.

The general construction of the jetties has been modified from time to time as the exigency of the work demanded, but in general it has been carried on as shown in the accompanying illustration. The trestle is driven from 600 to 800 feet in advance over the old mattress work and the caps, stringers and rails properly secured by straps, bolts and spikes. Then large sandstone riprap is unloaded on each side of the track. In the center and between the mounds thus formed there is unloaded small sandstone riprap to the same height as the mound, the whole forming an apron with a base of about 20 feet on top of the old mattress work. The trestle and apron are continued in advance and the work which was before an apron is now brought up to mean low tide with large riprap, the small riprap being filled in as before. This riprap slope is straightway protected with granite blocks to a little above mean low tide. A bracing gang then comes along and secures the bearing piles above the ravages of the Teredo navalis by a system of bracing, which also acts as an anchor and underpinning. Then the crest between and around the bents and underpinning and underbracing is filled with large and small riprap as before. Then over this riprap crest is laid selected granite block so as to conform as nearly as possible to the required cross section. The spaces between the blocks are then filled with large and small riprap, properly wedging and leveling off the crest, the whole presenting a comparatively smooth and even surface to the waves.




JETTIES AT GALVESTON HARBOR, TEXAS—SECTIONAL VIEW.

The sandstone riprap has been procured from Ledbetter, Quarry Station, and Heber stone quarries, Texas, and the granite comes from Granite Mountain, Burnet County, Texas. The minimum weight of the blocks of granite used is five tons, and on the arrival of the stone in the contractor's yard at Fort Point it is inspected as to its hardness, toughness, weight and durability. The hardness and toughness is determined by the hammer, the weight by specific gravity, viz., immersing a large sample of stone of known weight dry in a tank filled with water, then catching and weighing the displaced water and reweighing the sample wet, the amount of water imbibed by the sample is also noted; using the specific gravity data and the stone's general appearance, durability is determined, supplemented by immersing samples in sea water and carefully noting disintegration or change of any kind. The stone is also subjected to "M. Brard's method" of testing.

The jetties when finished will make Galveston the export and import harbor of a large section of country.

I am indebted for data to Major A. M. Miller, U. S. A., engineer in charge, Mr. E. M. Hartrick, assistant engineer, and Mr. C. H. McMaster, secretary, Galveston Chamber of Commerce.

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DR. FICK has shown that winking is more frequent as the retina becomes more fatigued, and it has been found that in reading at a distance of 30 centimeters the number of winks per minute is 1·8 with electrical illumination, 2·8 with gaslight, while with weak illumination which only permits reading at 18 centimeters the number is 6·8 per minute.

## The Nicaragua Canal and Its Competitors.

The report of the board of engineers appointed by the President to examine and report on the Nicaragua Canal project places the probable cost at $133,472,893 as against the $69,893,660 estimated by the canal company's engineers. In spite of the fact that it nearly doubles the estimates, the report is by no means fatal to the ultimate success of the scheme. Coming just now with its strong note of warning, it will prevent hasty action in an enterprise the gravity of which calls for mature deliberation; and far from delaying, it will probably, in the long run, promote the successful completion of the canal.

It has been proved repeatedly that estimates of the cost of engineering works which involve the excavation and removal of large masses of earth, gravel, rock, etc., especially in the construction of waterways, are liable to run far below the actual cost of construction. The Panama Canal is a notable instance of this, and the Manchester Ship Canal Company had outrun the first estimates long before the completion of the work, and were only saved from collapse by the liberal assistance of the city of Manchester. The cause of this discrepancy, particularly in canal excavation, is to be found in the uncertain nature of the material, the failure to make sufficiently thorough subsurface examinations by boring, and in unexpected interruptions by storms, floods, and other natural disturbances, which are liable to interfere with the execution of the work. It is evident from the report that the commissioner is of the opinion that the estimate of the canal company's engineers was based upon a too rapid and superficial survey of the route, and that the data was too incomplete for a reliable estimate of the quality and amount of the material which would have to be moved. The report, moreover, lays great stress upon the fact that the rainfall along the route of the canal is exceptionally heavy. At Greytown, the proposed Atlantic terminus, a record extending over three years showed a mean rainfall of over twenty-two feet, and on the west coast the mean for fourteen years was five feet five inches, varying between eight feet nine inches and two feet eight inches. In view of the fact that the proposed canal involves "the construction of numerous dams and embankments of magnitude, some of them without precedent in engineering practice, and all involving serious hydraulic problems," the necessity for obtaining accurate local records of the rainfall is apparent. As an instance of the discrepancy between the figures of the engineers of the company and those of the government engineers, it is sufficient to state that at a point a few miles below the Ochoa dam the former estimated the maximum flood discharge of the river at 42,000 cubic feet per second, whereas the latter estimate this discharge at 150,000 cubic feet.

The great Ochoa dam, in some respects an unprecedented undertaking, is estimated by the company to cost $977,000 and by the board of engineers to cost $4,000,000; and throughout the whole route, from Greytown to Brito, the estimates of the company are largely increased by the President's commission.

In concluding, the report recommends that a sum of $350,000 be spent in ascertaining by a thorough survey the necessary data for the drawing up of reliable plans and estimates. Such a survey would inspire confidence in the financial world, and would give a standing to the enterprise which it cannot be said to possess at present. The Nicaragua Canal Company is requesting that Congress guarantee its bonds to the extent of $100,000,000. Before any such sum is pledged to the construction of the canal it is not too much to ask that the nation shall know with some certainty what the actual cost of the undertaking will be.

Taking it altogether, if the final recommendation be carried out, the report should exercise a favorable influence upon the project; and it is likely that, when an exhaustive survey has been made, the commercial and strategic advantages of national control of the canal will lead to its being materially assisted by the government.

The abortive effort of the old Panama Canal Company to connect the two oceans is marked by a long stretch of incompleted work at the Isthmus. It is estimated that of the total sum handled by the company, about $100,000,000 was misappropriated by the promoters, and that about $150,000,000 was spent in the purchase of plant and in actual work upon the canal; while some $20,000,000 is held by the French courts and will be available should construction be carried on.

Mr. Robert T. Hill, of the United States Geological Survey, who has made a personal visit to the canal works, states that the canal commission has employed about 2,000 men during the past year, and that the plant is being kept in good order and will be available if work should be started. About twenty miles have been completed, and twenty-five miles remain to be cut. To complete the canal with six locks and a dam at San Pablo would cost $116,000,000 in addition to the $266,000,000 already spent. The work of raising this large sum of money is rendered difficult by the fact that public opinion in France demands that those who furnish the new capital shall share the dividends of the completed canal in common with the original shareholders.

Another scheme for the passage of shipping from ocean to ocean is that which proposes to build, at Tehuantepec, a ship railway capable of transporting vessels of 10,000 tons displacement. The advocates of this scheme believe that had it not been for the untimely death of Capt. Eads, who was an enthusiastic believer in the possibilities of the ship railway, it would have been built and in operation by this time. It was unfortunate, moreover, for the success of the Tehuantepec scheme that work on the Chignecto ship railway, from the Bay of Fundy to the Gulf of St. Lawrence, was shut down when it was within measurable distance of completion. Once the latter scheme is in successful operation, it is likely that an effort will be made to construct a similar road at Tehuantepec.

Elmer L. Corthell, in a recent number of the National Geographic Magazine, estimates the cost of the ship railway at $60,000,000. The relatively small cost of construction of the railway, and the fact that it would bring Atlantic and Pacific ports 1,400 miles nearer than the canal, are considerations which make it likely that if the Chignecto railway is successful, the building of the Tehuantepec line will be seriously considered.

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## Sustain the Vital Forces.

Sustain the vital forces! After all, this is the key to life. It is the guide to the restoration of health. It is the primary principle in the successful treatment of disease. Talk as you will about the invasion of the human body by bacteria. Sustain the vital forces, if you will render them powerless. Bacteria cannot thrive in the physiological field. The unseen enemies of this silent realm are rendered harmless in a body of perfect health. The fateful germ can only enter when its defenses are destroyed. Antiseptics may kill the germs or stop their propagation, but the main thing, after all, is to sustain the vital forces.

The old idea of battling with both nature and disease is exploded. He who depresses the system to get rid of pathological conditions is behind the time.

Germs are always with us, but they can do no harm unless through some breach they enter the sanctuary. Even then they are often rendered harmless, except it be some organism whose defensive mechanism is rendered weak through excesses or disease. Germs may produce disease, but health never produces germs. Deadly germs must live only in a pabulum homogeneous to their character; hence, so long as the strength of vital force is maintained, they are insignificant creatures.

Sustain the vital forces. In health this means to keep in health. It means good air, thorough cleanliness, good food, no excesses, labor in moderation, no mental worry.

In sickness, it means more. The flagging energies must be revived, stimulated, toned. Air, cleanliness, food, must be by special selection. Drugs can only do good when they rid the system of morbific matter and restore the function of organs. We aid in tissue building when we sustain the vital forces. We restore function by sustaining the vital forces. We drive out bacteria and render them harmless by so doing. The whole medical world is coming to this old tenet, which formed at the beginning of our reformation the keystone and head of the corner.—The American Medical Journal.

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### TYPEWRITING AND ADDING MACHINE.

The accompanying illustration presents a machine intended to cover a substantially new field in typewriting and adding machines. It is the property of and is being manufactured by the Numerograph Manufacturing Company, of Charleston, W. Va., under patents to George W. Dudley, No. 554,993, 555,038 and 555,039, of February 18, 1896.

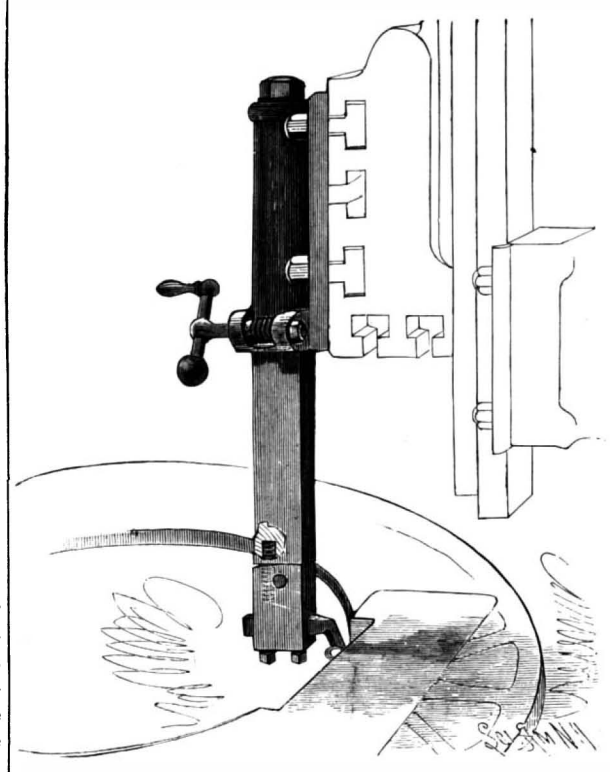
The object of the invention is to quickly and accurately add a column or columns of figures and, at the same time and by the same manipulation of the keys, to print upon a sheet of paper or a blank book these figures in the order in which they are added, so as to form a proof sheet which shall verify the correctness of the addition, and which machine, by special adjustments, may be made to print at the end of the column the sum total of the column, and to do the work in a vertically descending progression or vertically ascending progression or in a horizontal progression.

It verifies, by printing in full sight, each figure to be added at the same time the addition is made, and is so constructed that, if the proper key is struck, the result must be perfect. It works with the ease of a typewriter and its speed is only limited by the skill of the operator. It subtracts by reversing the machine as readily as it adds; in other words, the registering disks run one way as readily as the other. It carries automatically. The keys all work in the same horizontal plane and have for each figure the same dip or extent of depression. Its construction is simple, considering the variety and extent of work done, and its action in all its parts is positive. It is adapted to printing on pass books with the same facility as upon the ordinary platen and sheet. Additions can be made either to the right or to the left. It can be used to add without printing or to print without adding. Mistakes, if made, can be seen at once, and corrected as easily as mistakes upon the typewriter. The illustration represents a double machine, upon one side of which can be kept the debts and on the other the credits, and a balance can be struck by deducting the one from the other, as shown in the example given.

OAKLAND, Cal., claims to be the healthiest city in the world, or, at any rate, in the United States. The death rate has fallen since 1882, when it was 13·56 a thousand. Last year it was 11·85 a thousand. This approaches near to the sanguine sanitarian's ideal of 11 in a thousand.

### AN INGENIOUS TOOL HOLDER ATTACHMENT.

The accompanying illustration shows an ingenious device for reducing the friction of the tool of a slotting machine on the return stroke across a piece of work. As ordinarily made, the tool flap is of heavy construc-

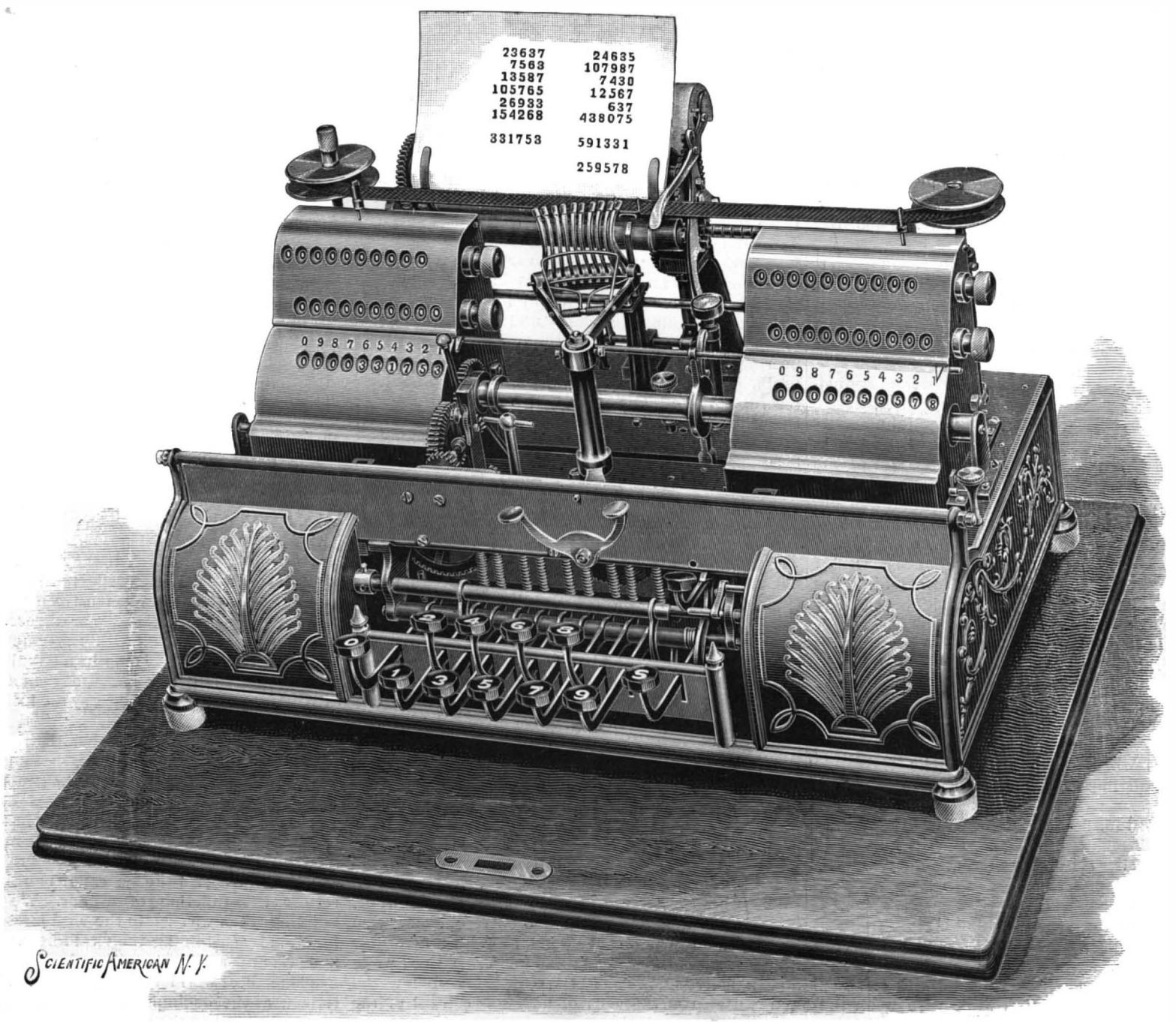


TOOL HOLDER ATTACHMENT.

tion, and it bears against the work with a greater pressure than is desirable, tending to spoil the edge of the tool. To reduce this pressure and lighten the tool flap, Mr. Johnson, the master machinist at the Watertown Arsenal, has designed the attachment which is herewith shown at work on a slotting machine. It will be seen that the sliding head is provided with a stout, downwardly projecting tool holder, which is held in a vertical pocket. At its lower end the tool holder is provided with a hinged tool flap, which is so arranged that the tool can swing backward, as usual, to clear the work on the return stroke. The tool is held against the work by the action of a small coil spring, which is located in a recess drilled to receive it in the body of the vertical bar. The holder with its tool can be rotated by means of the hand crank and worm gear, carried on projecting lugs at the base of the sliding head.

### On Some Physical Properties of Argon and Helium.

Lord Rayleigh has made a new determination of the specific gravity of argon, using a large volume of the gas separated from atmospheric nitrogen by sparking with oxygen. The result obtained, referred to $O_2$ as 16, was 19·940. Prof. Ramsay had previously obtained a density of 19·941 for the gas obtained by the magnesium method, so that it is evident that the products obtained by the two methods are identical. The author has also determined the refractivity of argon and helium, with the results that the refractivity of argon is 0·961, while that of helium is 0·146, compared with air as unity. The result in the case of argon is very unfavorable to the view that this gas is an allotropic form of nitrogen. The refractivity of helium is remarkably low, the lowest previously known being that of hydrogen, which is nearly 0·5 that of air. The results of determinations of viscosity were for helium 0·96 and for argon 1·21, referred to dry air. The latter number is somewhat higher than that for oxygen, which has stood at the head of the list of the principal gases in this respect. The author has found, says the Chemical News, by spectroscopic examination that the gas emanating from the Bath springs contains both argon and helium, with probably less than 10 per cent of the latter in the mixture of the two. Gas from the Buxton springs was found to contain about 2 per cent of argon, while the presence of helium in this gas in very small quantity was probable, but not certain. The interesting question concerning the existence of helium in the atmosphere was attacked by allowing the greater part of samples of atmospheric argon to be absorbed by water and examining the residues by the spectroscope. It was expected that helium, since its solubility in water is but about one-fifth that of argon, would be concentrated in these residues if it were present. No helium could be detected in this way, and the author concludes that if helium be present in the atmosphere, it must be in very small quantity, probably much less than a ten thousandth part.—American Journal of Science.




THE DUDLEY TYPEWRITING AND ADDING MACHINE.

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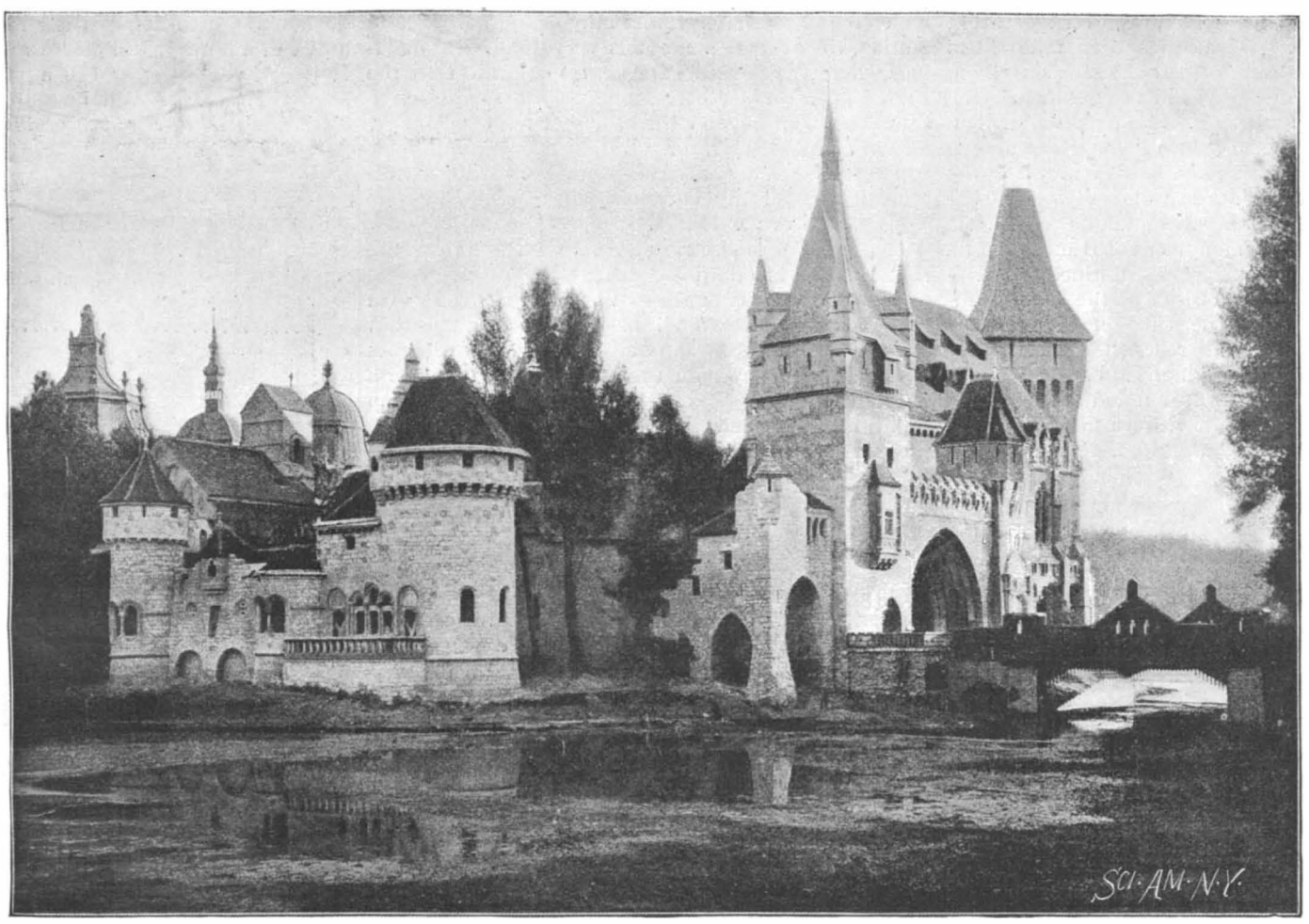
## THE HUNGARIAN MILLENNIAL EXPOSITION OF BUDAPEST.

When a people can look back to the ninth century for the beginnings of its national existence, and trace its development down to the present time, it is natural that it should not only cherish a just pride in its antiquity, but wish to celebrate the thousandth anniversary in such a manner as to attract the attention of the nations of the world. The Hungarians, led by Arpad, established a new nation in the year 896, and now the descendants of this intrepid host honor the thousandth anniversary of that event by giving at Budapest a "Millennial Exposition" which is unique in character and extensive in scope.




THE HUNGARIAN MILLENNIAL EXPOSITION AT BUDAPEST—CASTLES AND TOWERS OF THE NINTH AND ELEVENTH CENTURIES.

For the Exposition, the most beautiful park of Budapest has been selected, and it has been beautified by the erection of bridges to unite the various portions of the park. From the banks of the natural and artificial lakes and streams rise fortresses in imitation of those of centuries ago.

The directors have wisely planned an educational exposition on a gigantic scale. The thousand years of Hungary have been divided into eight distinct epochs. To each of these a separate building of appropriate architecture has been assigned, and the contents are illustrative of that period, showing its arts, industries and history. Every one of the nineteen nationalities of the realm has a village in the grounds, where are carried on the daily vocations of home life, thus giving, for the first time, an ethnographic picture of the kingdom.

The section devoted to modern times includes all that may be expected in an exposition which illustrates Hungary. It is not an international exposition in the sense that all the work of the world is to be shown there, as in Chicago or Paris; it depicts the Hungarian nation, and no other.

The Exposition grounds occupy 129 acres. There are about 169 buildings and pavilions, which were erected at a cost of $4,000,000. The Exposition was opened with imposing ceremonies on May 2, by the Emperor Francis Joseph, as King of Hungary; it will remain open until October 31. During the continuance of the Exposition, there will be an almost uninterrupted series of festivities. In nearly all the towns and cities of the land monuments and institutions will be inaugurated. Among the most important of these events will be the laying of the corner stone of the triumphal arch, which will cost 800,000 florins, and the opening of the new Parliament House, one of the most magnificent buildings in the world, which has cost $6,400,000. The new waterway, built by Hungarian engineers through the "Iron Gates" of the Danube, will be thrown open to international traffic. Some time during September, an historical pageant will be held. More than 2,000 persons will take part in it. Its object is to depict in vivid colors the most important political events, historical heroes, etc., all clothed in costumes appropriate to the epoch they illustrate. In spectacular effect this gala procession will outdo anything of its kind yet seen.

The Historical building, which we illustrate, is a composite palace or rather group of buildings. For the following description we are indebted to an enterprising American journal, the Hungarian American. The historical section is on the Széchényi Island. The

THE HUNGARIAN MILLENNIAL EXPOSITION AT BUDAPEST—THE HISTORICAL BUILDINGS.

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group of buildings is made up of individual elements, each one of which expresses a distinct period of architectural evolution, as Romanesque, Gothic and Renaissance. Segesvár has afforded the model for one tower, while the higher is a union of numerous suggestions found in the famous ruins of the country.

The Vajda-Hunyad castle contributed the balcony, Diakovár the portals, the arch and the coat of arms. The fourteenth century Gothic has been followed in the body of the building. Instead of a king's pavilion, apartments have been prepared in the "Roman" (Romanesque) historical building. This idea is a particularly happy one. The façade of the Romanesque building is one of the most remarkable features of the whole exhibition. It is a copy of the front of the church of Ják, a pearl of the Romanesque period. It is the oldest architectural monument of Hungary. The whole structure of the Exposition is destined for memorial, historical and artistic objects of the oldest Hungarian historical period—the time of the Arpads. Here in the midst of venerable relics the King of Hungary will receive the guests of high rank.

The Hungarians have long been noted for their hospitality, and from all accounts visitors to the Exposition give the citizens of Budapest high praise for their attention to strangers.

### The Wonderful Development of the Electric Elevator, and the Cause Thereof.

BY WILLIAM BAXTER, JR.

The practical application of the electric elevator has progressed in such a quiet and unobtrusive manner that very few outside of those directly interested in the industry have anything like a correct impression of the extent to which it is used at the present time. When the electric motor first came into use, and it was demonstrated that it was a substantial and serviceable machine, its use for the operation of elevators was at once suggested, and many were installed for such service. But in all these early applications, an ordinary stationary motor was used to drive a belted elevator machine of the type generally used in factories, where they are driven from the line shaft by an open and a cross belt. To-day there are probably not far from one thousand elevators of this class in New York City that are operated by electric motors.

The real electric elevator, however, did not come into the field until about eight years ago. At that time some of the most progressive elevator builders concluded that a self-contained electric elevator would find a wide field of application in all small buildings where a hydraulic plant could not be installed, either on account of lack of space or cost of operation. From time to time since then many of the hydraulic elevator builders have added an electric machine to their list of apparatus. And at present all the prominent concerns are manufacturing them. About five years ago new corporations came into the field as manufacturers of electric elevators exclusively. The older builders have always maintained that for thoroughly first-class installations the hydraulic elevator was the only proper thing, and that the place for the electric was in small buildings, where cost of operation and installation constitute important factors.

The manufacturers of electric elevators exclusively, on the other hand, insist that the electric is the best for all cases, and that it is only a question of time when it will drive the hydraulic out of existence, as effectually as the latter drove out the steam elevator, which twenty-five years ago held almost undisputed possession of the field.

What the final outcome of this contest will be would be difficult to predict. At the present time it looks very much like an unequal fight; for the opponents of the electric elevator as a rival of the hydraulic are really between two fires. They cannot advocate the electric very strongly, as they desire to maintain the supremacy of the hydraulic, and if they endeavor to depreciate its merits too much, they only succeed in creating the impression that their confidence in their own electric apparatus is not very strong, and this they cannot do, as it would give their rivals in the electrical field an advantage.

That the sphere of usefulness of the electric elevator is not confined to as small and unimportant plants as the builders of hydraulic apparatus have been accustomed to claim can be demonstrated by the character and size of the buildings in which they are now used. Within the past two or three years, a large number of new buildings have been erected in Broadway and the adjoining streets between Canal and Fourteenth Streets.

These buildings are, with few exceptions, modern fireproof structures, from eight to twelve and more stories high. Some are used as manufacturing establishments, and others as show rooms for out of town firms and as office buildings. In outward appearance as well as in interior decoration some of them rival more pretentious structures down town.

An inspection of these buildings will show that nearly all of them are provided with electric elevators. In most cases only one or two elevators are used, but in some of the larger buildings as many as four or six may be found.

In all these cases the current is taken from the electric light mains running through the street, and the cost of operation is found by actual experience to be very low. This is due to the fact that the charge for current is based on the quantity used, as indicated by a meter, and as the elevators only use power when in motion, the average amount is very small. In buildings where the elevators are kept in constant use the charges per car are correspondingly high, although they seldom go beyond thirty-five or forty dollars per month for each elevator. But in smaller buildings, where the elevators only run in answer to a push button call, the monthly current bills run as low in some cases as five or six dollars.

The builders of electric elevators, exclusively, claim that in larger installations, where a generating plant is used, the operating expenses would be less than with hydraulic elevators. Their basis for this claim is that the electric generators can be driven by steam engines of higher efficiency than the steam pumps used for a hydraulic system. To offset this the hydraulic men claim that as in their system pressure tanks are used, the size of the pumps can be made nearly equal to the average power required to keep the elevators in motion, because the pressure tanks act as a storage reservoir; but as no such energy storing device is used with the electric system, the capacity of the engines must be equal to the maximum demand, and therefore that their average rate of working will be so far below the point of highest efficiency that their actual economy over the steam pumps will be small, if any at all.

This claim would hold good if a single elevator were used, but in any case where a generating plant would be installed, the number of elevators would probably not be less than four or five, and might be many more. Now, when a number of cars are used, the capacity of the generating plant would not have to be much in excess of the average, because all the cars would not have to do the maximum work at the same time.

The introduction of an electric elevator plant in buildings of the most pretentious class may not depend so much upon the relative economy of a complete electric system as compared with a complete hydraulic system as the contending factions appear to believe. In large buildings heretofore erected, it has been customary to install an electric lighting plant, because under the conditions existing it was found that the cost of lighting could be greatly reduced in that way. A battery of boilers and an engineer and fireman were required in order to furnish steam for the hydraulic elevator plant, and the addition of an engine and an electric generator only increased the operating expenses by the amount expended for a few tons more of coal. The cost of this coal was found to be so small a percentage of the charge of the lighting companies for current as to enable the saving to soon pay for the cost of the electric plant.

Inasmuch as the use of electric elevators operated by current taken from the street mains renders the use of boilers, engines, engineer, and fireman unnecessary, it becomes a question whether even in the largest buildings it would not be more economical, and convenient in every way, to discard the generating plant. The fact that in some large buildings where electric lighting is used, and where there are a number of electric elevators, this plan has been adopted would show that in these cases at least such a conclusion has been arrived at.

### Conversion of Emery into Corundum.

Mr. Hasslacher has patented an electric process of converting emery into corundum by means of the arc of alternating currents. As heat and not decomposition is aimed at, continuous currents would be unsuitable. The furnace is made of firebricks and stands on two bridges; the hollow underneath serves as receptacle for the fused mass, there being a small hole in the bottom of the furnace. This hole is covered with a glass plate. The electrodes (carbon rods) are approached to within one or two inches; the interval is packed with lumps of carbon. The emery, also the finest dust, of little use otherwise, is mixed with powdered coal, the amount depending upon the iron oxide in the emery; for 25 per cent of oxide 5 per cent of carbon is reckoned. The coal lumps are soon burned by the oxygen of the iron oxide and the arc forms under hissing. The inner mass begins to melt, the glass plate gives way and a stream of fused corundum flows out. The hard outer crust is then broken with iron rods and new material thus fed to the arc. This addition stops the flow, which starts again after ten or fifteen minutes. The base plate is strewn with fine emery powder to protect it from the intense heat of the fused mass. The resulting corundum is almost free of water, of which the emery contains about 5 per cent. It is crystalline, colorless, and then resembling quartz; pink or blue, fine, small crystals of sapphires have been found in druses. The current is kept at 250 amperes and the pressure is 40 or 60 volts.—The Trade Journal Review.

### Notice to Our Readers.

In order to obtain the opinion of the readers of the SCIENTIFIC AMERICAN as to what invention *introduced within the last fifty years* has conferred the greatest benefit upon mankind, we publish the accompanying card, which please cut out and return to the editor. Those who preserve the paper for binding and do not desire to deface their files, or who read this notice at a library, will please answer by postal card. It is desired to get as full a vote as possible. The result of the vote will be published in the *Special 50th Anniversary Number of the* SCIENTIFIC AMERICAN *on July 25.*

Editor of the SCIENTIFIC AMERICAN.

Dear Sir:

I consider that.....

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invented by..... .....

has conferred the greatest benefit upon mankind.

Name.....

Address .....

### How Artificial Monstrosities Are Made.

Prof. J. A. Ryder, of Philadelphia, has recently made research of some length into the methods by which the Japanese have produced the race of double-tailed gold fish, Carassius auratus, which are such favorites with fanciers and the owners of aquaria in this country; and, incidentally, he has also called attention to some very interesting facts of a like nature regarding other allied vertebrates. The experiments of Weber, proving that the eggs of the common pike could be caused to produce double monstrosities if the recently fertilized eggs were violently shaken, were the initial discoveries that have led to the present doubling from a single yolk. This fact is known to our fish commissions, and great care must at first be used to prevent the almost entire production of monstrosities by rough handling. More remarkable still is the conclusion reached by Von Ihering that certain armadillos normally produce several young from a single fertilized egg. Dr. Ryder is inclined to regard the double-tailed gold fish as "the actual realization of an eight-limbed vertebrate," a thing most contradictory of our present basis of animal classification. These fish have been produced in Japan, he concludes, for at least two centuries, and they there command high prices among the wealthy classes, the finest or most abnormal variations being in great demand. By taking the eggs of the normal species of gold fish and shaking them, or disturbing them in some way, the Japanese get double monsters, some with double heads and a single tail and some with double tails. Naturally the complete double monsters would be unlikely to live, while those with only the duplication of the tail, having the problem of life in no way complicated for them, would be quite likely to survive. These monstrosities, being selected and bred, would in all probability hand onward the tendency to reproduce the double tail, which in time would become fixed and characteristic, if judicious selection were maintained by interested breeders, as has been the case with the many breeds of dogs, horses, fowls, and pigeons. Barfurth, experimenting upon tadpoles, has found the duplication of the tail in them has much to do with the manner in which it is removed. For example, if the tip of the tail were snipped off exactly at right angles to the axis of the body, the tail was regenerated of the normal form and straight backward. If removed at an acute angle, regeneration took place so that the new tip was directed either upward or downward, according as the inclined, regenerated cut surface looked upward or downward. These facts cannot be dismissed as useless in connection with the problem of inheritance in general; for while, as we rise in the scale of organization, the tendency to regenerate lost parts becomes more restricted, the tendency to produce monstrosities due to disturbances of development remains in full force, as is illustrated by the disposition to reproduce extra toes in the cat, the same tendency hereditary in the Dorking fowl, or even the disposition to reproduce extra thumbs or toes in the human family.—Dr. Eugene Murray-Aaron, in Popular Science News.

### Central American Exposition.

Minister Arraiga, of Guatemala, has informed the Department of State that a Central American exposition will be held at Guatemala la Nueva, the capital of Guatemala, next year from March 15 to July 15. Though the exposition is of a Central American and not of a universal character, it will nevertheless include a foreign section where the exhibitors of other countries may show their wares, and a cordial invitation is extended by the Guatemalan government to the citizens of the United States to be represented.

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### A NOVEL POCKET CAMERA.

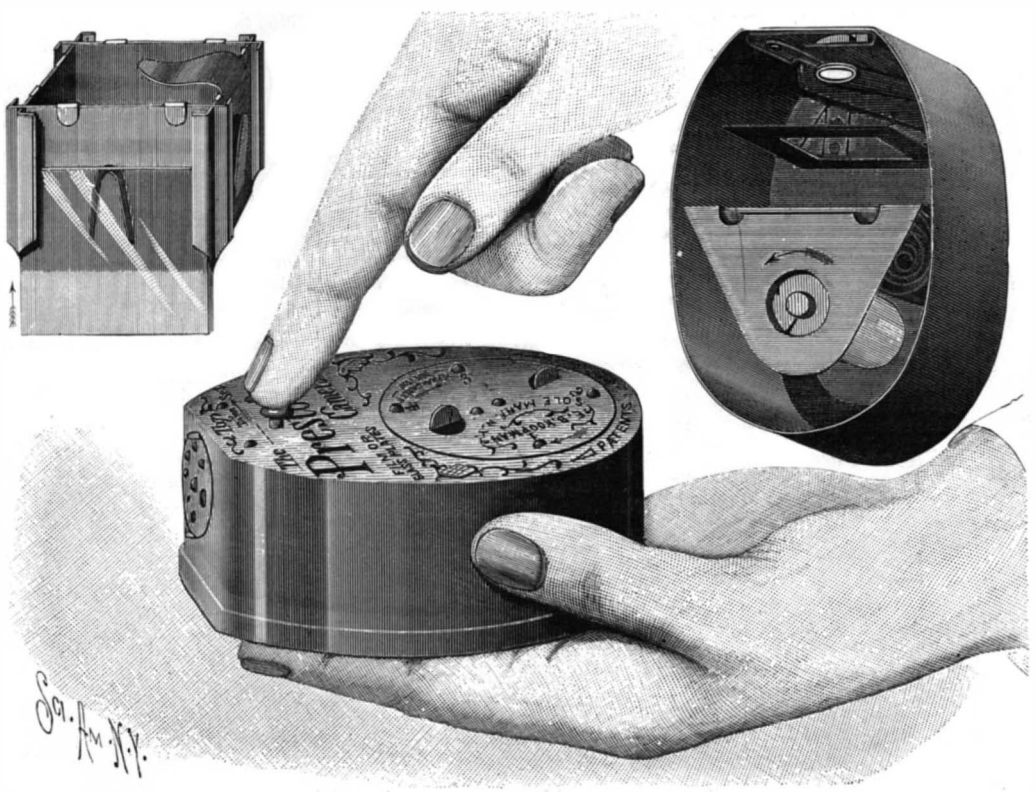
Within the past few years the development of compact, light miniature cameras, easily operated yet capable of producing clear, distinct pictures, has been nearly as remarkable as the perfection of the bicycle. Inventors have studied the problem of making a camera so simple in its working parts that it cannot readily get out of order, yet will be so easily understood as to enable any person who may have had no previous knowledge of photography to make satisfactory pictures. In presenting illustrations of the little camera named "The Pocket Presto Camera," we show a novelty and simplicity of construction which speaks for itself, and an illustration of the actual size of one of the pictures made with it. As will be seen in the larger lower view, the camera consists of an elliptical shaped sheet metal body about three inches long, having the front end square. The cover is made of one piece of metal and is put over one side of the camera, occupying the bottom when in position, the outer lip of the cover overlapping the outside of the camera, as may be seen in the illustration, while an inner concentric lip or projection on the inside overlaps the inner edge, thereby forming a light-tight joint. By such construction the interior (see the upper right hand view) is readily accessible for loading or unloading.

THE POCKET CAMERA PICTURE, ACTUAL SIZE.

Another feature is that it is a roll holder and plate camera combined; the triangular shaped portion observed in the view just mentioned is made of metal and holds near its apex a wood spool around which the exposed film is wound after passing from a special pocket in which it is placed when loading over the straight or focal plane portion, the arrow indicating the direction of the revolution of the spool. A small hole in the face of the end of the spool engages a pin projecting from the underside of the rotating disk, and the center hole of the spool fits over another pin around which the spool rotates. The rotating disk will be noticed on the rear of the outside of the camera in the larger view and has convenient outward projections for the fingers to push against in making a revolution. It is also provided with four detents which fit over slight projections arranged at each quarter of a circle, so that a slight click is heard as each quarter turn is made. The camera is supplied loaded with sufficient film to make twenty-five pictures, but has a capacity for fifty. In rotating the spool of film the disk is turned half a revolution or until two clicks are heard. If it is desired to use plates, the film holder is removed in the usual dark room and a square shaped metal box holding a miniature glass plate on each side, four in all, is slipped over the same pins that secured the film holder. The view of this is seen in the upper left hand corner. Tongue-shaped flat springs press the plates outward as they are slipped into the grooves. When in position and the cover replaced, the camera is loaded with four plates, and it is only necessary to rotate the large disk one-quarter of a revolution to bring a fresh plate into the focal plane. Located behind the lens is a vertical plate with a rectangular aperture to cut off the marginal rays of the lens. The miniature lens is held in place by a flat spring and is adapted to be easily removed for the purpose of cleaning when necessary. The shutter directly in front of the lens is of a gravity, pivoted, segmental type, works freely and has no springs to get out of order. The operation of setting the shutter is very simple. The larger illustration shows the method of making the exposure. The rotating diaphragm disk on the front contains three openings for instantaneous and time work, and has detents and projections for stopping it at the right place and for turning similar to the film-rotating disk. The pocket device for holding the film is quite simple and ingenious, but its working need not be explained here.

Suffice it to say there has seldom been a camera made which has such a large capacity confined in so small a space and one that cannot become disarranged by rough handling. In addition to this the price is so reasonable that any lad or lass can afford to have one, while the pleasure it will give to hundreds who never thought of taking photographs cannot be estimated.

The sole manufacturer of this camera is Mr. E. B. Koopman, 33 Union Square, New York City.



THE POCKET PRESTO CAMERA.

### A Battleship Turret Tested to Destruction.

A trial was made last week at the Indian Head proving grounds to determine whether the internal structure of the turrets of our battleships would properly support the 15 inch armor when it was struck by a shot from the heavier guns. When a 13 inch shot strikes a turret, its 36,000 foot tons of energy are partly resisted by the dead weight of the turret, and partly by the clips which hold it down upon the turntable path on which it revolves. The blow also tends to burst in the particular plate upon which it falls, and this has to be resisted by the plate steel framework upon which the armor is built up. The turret, for the purpose of the trial, was placed upon a solid horizontal platform and rested upon large steel cylinders, representing the rollers upon which it rests when on ship.

Three shots were fired, with the following results: A 500 pound shot from a 10 inch gun struck the 15 inch plate near the top with a velocity of 1,700 foot seconds, penetrated six inches, and broke up. The framing was uninjured.

A 12 inch shot, with 1,700 foot seconds velocity, also broke up, the point remaining welded in the plate. The framing to the rear was uninjured, but one bolt holding the armor plate was sheared off, and the plate was cracked from top to bottom. The plate was not moved from its place upon the structure; but the entire turret was moved seven inches to the rear.

A 12 inch shot with 2,000 foot seconds velocity pierced the 15 inch steel plate, the backing, and the framework, and passed through the entire turret, smashing the cast iron plate on the rear face. The framework "was torn and twisted in all directions in the vicinity of the place of impact." The whole turret was again moved bodily to the rear, this time about six inches.

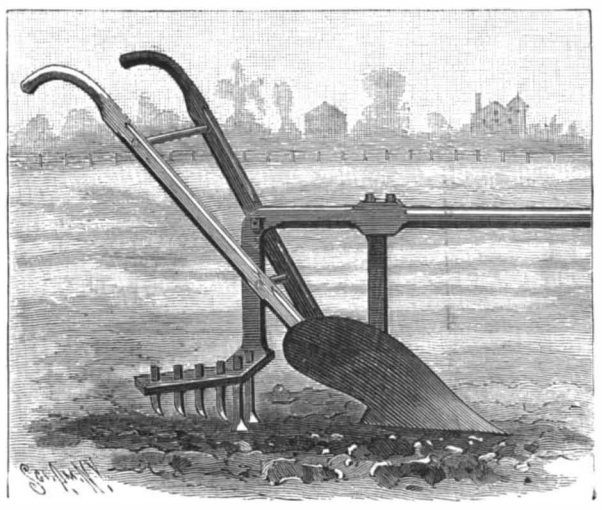
The results are considered to be satisfactory both as regards the 12 inch gun—which is the type to be mounted on the Iowa—and as regards the turret, which is the same as those on the Indiana. It is considered that the turrets would have furnished good protection to the guns and crew within it, and that the holding-down clips which are used in actual service would have proved amply sufficient to keep the turret in place.

### Work with the Electric Furnace.

Prof. Dewar in a recent lecture at the Royal Institution paid tribute to the work of M. Moissan with the electric furnace. M. Moissan was indeed the pioneer in the work of research comprised in the combination at high temperatures of carbon with various elements. Prof. Dewar, referring to the fact that many of the carbides thus obtained are decomposed by water, pointed out that many years ago Prof. Mendeleef speculated that the only way to account for the immense localization of petroleum at Baku and other centers was that it was being continuously generated by the action of water on carbides. This idea was not favorably received at the time, but it has now met with a certain degree of acceptance. Benzine, the product of acetylene, generated by some of the carbides, is the nucleus of all the colors hitherto obtained from coal tar products. Benzine by the acetylene process is reached in three distinct stages. First, the combination of lime and coal in the electric furnace; second, the decomposition of the resulting carbide by water; and, third, the transformation into benzine of acetylene gas by means of heat.

### A SUBSOIL AND HARROW PLOW ATTACHMENT.

The accompanying illustration shows a plow attachment, for which a patent has been granted to Tom M. Bowers, of Crockett, Texas. It will be seen that the share and handles may be of ordinary construction. The beam is extended to the rear and bolted to the left handle, where it is provided with a vertically depending portion, at the bottom of which is firmly fixed a laterally projecting wing. From the point of its attachment to the vertical bar the wing projects across the furrow at right angles to the same,



A SUBSOIL AND HARROW PLOW ATTACHMENT.

and it is then inclined rearwardly, as will be seen in the illustration. The beam, with its horizontal and vertical extensions and the projecting wing, may be made in separate parts, or integrally, as desired. The wing is slotted to receive six teeth. Two of these, which are intended for subsoiling, are made of extra length and are arranged immediately behind the share and next to the vertical extension of the beam. They are flattened out at the toe, so that they may the better loosen up the deeper soil, and tend to create underground drains, in which the surplus water may collect and be carried off. In dry weather, moreover, the loosening up of the subsoil will enable it to retain the moisture for a longer period. The harrow teeth are made of different lengths, gradually decreasing toward the outer end of the wing. The object of the invention is to secure the advantages of plowing, subsoiling and harrowing in one machine, and it is claimed that by arranging the devices for the latter work as shown the three operations are thrown into one and the draught upon the plow is but slightly increased as compared with the great gain in time and labor.

EXPERIMENTS have been carried out by Bruttini on the subject of the influence of salts on the sprouting of seeds and the results are thus described by Prometheus: "The experiments were tried in the following manner: Fifteen seeds were placed for twenty-four hours in solutions of 1 to 2 per cent of different salts, and then compared, in respect to germination, with fifteen other similar seeds kept for the same time in pure water. At the end of four days all these last had sprouted, while the others gave variable results. With potassium nitrate the fifteen seeds sprouted in equal degree, while with mercuric chloride not one sprouted. Sodium chloride exercised a marked injurious effect, and so did potassium phosphate, while potassium permanganate had only a very weak effect. Chloride of iron in a two per cent solution destroyed all germination; with a one per cent solution only two of the seeds sprouted."

IT is expected that Sir William Martin Conway's expedition to Spitzbergen will occupy altogether about three months. The arrangements are not settled yet, but it is probable that the party will leave this country early in June, and return at the end of September. This practically implies the period of the year during which Spitzbergen is open to the sea. A good deal of interest attaches to the expedition, for at present the interior of Spitzbergen is not well known to us.

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## RECENTLY PATENTED INVENTIONS.

### Engineering.

PROPELLER.—Nelson W. French, Sayre, Pa. This inventor has devised a propeller in which each paddle or blade is four feet long for one foot wide, and about a third longer than the diameter of the propeller, the blades thus having much greater superficial area than those of the common screw. The blades are flat, and preferably arranged at angle of forty-five degrees to the shaft, being secured to oval or elliptical shaft sections arranged with their longer axes at right angles to each other, the arms being adjustably clamped along the shaft.

STEAMBOAT JACK.—Samuel R. Judd, Little Rock, Ark. To raise boats or vessels when aground, this invention provides for a series of lifting jacks carried on the vessel, and having plungers with rolling supports at their lower ends to be lowered to the bar or reef on which the vessel lies. Along the sides of the hull of the vessel are stanchions forming vertical guides in which the jack frames move.

COAL CHARGING HOPPER.—Donald McDonald, Louisville, Ky. To charge coal or coke into a hot gas generator, against gas pressure, or to charge limestone into a kiln, this inventor provides a rotary hopper to turn in one direction and register with an opening in the base for the discharge of its contents, an opposite turning closing the base openings and refilling the hopper, which has a close fitting cover to prevent all escape of gas in both movements, while the lower face of the hopper has a clearing flange in close engagement with the upper face of the base.

### Railway Appliances.

CAR AXLE BOX LUBRICATOR.—James S. Patten, Baltimore, Md. This is an improvement on former inventions of the same inventor in lubricators which have oil take-up rollers working in contact with the axle journals, and relates chiefly to the journal cap used in connection with the lubricant receptacle, and also to the pivoted frame carrying the oil take-up rollers, as well as the spring which supports the lubricant holder in the car axle box.

LOCOMOTIVE TRUCK JOURNAL BOX.—Charles Linstrom, Vicksburg, Miss. This improvement provides for securely fastening the oil cellar in place on the inside of the journal box, where it will not be liable to get out of order from the jars and shocks of the truck frame. The invention provides for one or more angularly held pins extending from the journal box into openings in the oil cellar, the pins being conveniently removable to unlock the oil cellar and allow it to be removed.

### Mechanical.

A STEAM HAMMER HAND TOOL.—Arthur C. Beckwith, Chicago, Ill. This invention provides means for actuating a chisel or other tool by steam or other motive agent, a cylinder having at one end a chisel or other tool bearing and at its other end a handle, the cylinder having inlet and exhaust ports and a sliding and turning piston to strike the tool. The piston has channels and ports registering alternately with the inlet and exhaust, and forms its own valve for controlling the admission and exhaust of the motive agent.

GLASS POLISHING WHEEL FEED.—Thomas F. Gilroy, Brooklyn, N. Y. To facilitate polishing the beveled edges of glass, this inventor has devised a machine in which the polishing material is automatically and evenly spread on the polishing wheel and is maintained in solution. A brush is made to move into and out of the polishing material and have a reciprocating movement on the wheel, the operator holding the glass in proper position on the wheel as it rotates.

AUTOMATIC DOCTOR.—Thomas H. Latimer, Wilmington, Del. In a calendering machine in paper making this invention provides an improved automatic doctor and feed of simple and durable construction, whereby the pressure of the doctor upon the rolls may be conveniently increased or lessened, and automatic and instant relief will be afforded in case of an accumulation of paper at or on the rolls without danger of the doctor striking the next lower roll.

### Miscellaneous.

GLOVE CASE.—Alfred W. Vess and Henry C. Kenney, Athens, Ga. This is a case for holding and exhibiting gloves of different kinds and prices, to prevent their being mussed, wrinkled and discolored by the prospective purchaser desiring to make a selection. The top and front of the case are of glass, and in it are tiers of slides, the upper portion of each slide being exposed, it being intended that gloves of the same size be arranged and held on a slide by clips. The case affords a regular gradation for size and a variety of colored gloves, all removably held on the slides, and readily distinguished without handling the goods.

NECK YOKE FASTENER.—Thomas Thompson, New London, Wis. For fastening the pole strap of a harness to the neck yoke, this invention provides a ring to slip on the end of the neck yoke, a slotted projection on one side of the ring forming a keeper to engage the yoke strap, and the ring having a keyway registering with a projection on the neck yoke. The ring also has slots to receive a removable ring lining. The device enables the connection between the strap and the yoke to be instantly made or readily released.

DESIGN FOR A RACK.—Martin V. B. Pabor, Fredericktown, Mo. This invention relates to racks for supporting hats or other apparel, or to receive cards, and the design is in the shape of a Maltese cross, with diamond shaped center panel. Ornamental hooks are arranged on the arms of the cross and a shelf is suspended by chains along the edge of the lower arm.

PNEUMATIC MAIL COLLECTOR.—Hans Fleckl, Chicago, Ill. This is an improvement in pneumatic apparatus in which a car driven by air pressure is propelled through an underground tube and automatically gathers the mail matter deposited in boxes at various points and brings it to a central station. In the inner walls of the tube are receiving cavities of different sizes for different stations, and the traveling pistons have supplemental pistons to fit the different cavities. When the collecting cars have been sent to all the boxes, a suction is created at the central station and the pistons and mail cars are successively drawn back.

HYDROCARBON BURNER.—Thomas J. Brough, Baltimore, Md. An air mixing oil burner is provided by this inventor for burning crude oil for heating or illuminating without a wick, producing a blue blaze of the greatest heating capacity when used for heating without smoking or depositing its carbon. The invention covers a novel cap or deflector designed for special combination with a spiral coil of pipe, the oil being heated and volatilized in the coils without obstruction to the draught.

STOVE DAMPER AND GAS OFFTAKE.—James A. Carroll and William Brooks, Brooklyn, N. Y. According to this improvement, a gas off-take pipe extends through the pipe damper into the smoke pipe, the inner end of the offtake having a flaring mouth over the bed of fire. The device is especially adapted for use with cylinder stoves and does not interfere with their feeding, but prevents any gas from passing into the room.

HAND TREADLE DEVICE.—David Curtin, Indianapolis, Ind. This is a hand attachment intended especially for use with sewing machines. The hand lever is pivoted to a bracket secured on the under side of the machine bed, and the lever is connected with a pitman which at its lower end is attached to the treadle. The construction is simple and inexpensive and the attachment is easily applied and removed.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

## NEW BOOKS AND PUBLICATIONS.

THE STEAM ENGINE CATECHISM. A series of direct practical answers to direct practical questions, mainly intended for young engineers and for examination questions. By Robert Grimshaw. Tenth and enlarged edition. New York: Norman W. Henley & Co. 1896. Pp. 413. Price $2.

We have before now had occasion to commend Mr. Grimshaw's excellent method of presenting mechanical subjects. He seems to be able to give life to what would normally be a rather dry subject. The present book, in the form of questions and answers, consists of two parts, the original Steam Engine Catechism and the Supplement thereto, and in every way justifies our impressions just expressed. The catechism form of writing seems to be peculiarly adapted to practical mechanics; at least, this type of book has had a very great vogue, so great a vogue as to warrant its continuation. It is to be noted that this is the tenth and enlarged edition of the catechism, and in its over 400 pages of text it contains a vast amount of most useful information. The next book that we notice is a species of supplement to this.

THE ENGINE RUNNER'S CATECHISM. Telling how to erect, adjust, and run the principal steam engines in use in the United States, being a sequel to the author's Steam Engine Catechism. Profusely illustrated. By Robert Grimshaw. Second edition. New York: Norman W. Henley & Co. 1896. Pp. 366. Price $2.

Mr. Grimshaw in this book, which is really, as has been said, a species of supplement to his Steam Engine Catechism, takes up the different makes of engines now on the American market and, one by one, describes their peculiarities and how they should be manipulated. It is evident that this is precisely the information an engineer needs. Whoever has begun with this book and studied the mechanics of the large number of typical engines it describes will be prepared to cope with any engine that should be put in his hands. But his treatment of special engines is, by no means, all the book contains. The shipping and receiving of engines, making of foundations, erecting and starting, with detailed instructions as to the adjustment of special makes, are all treated very fully, and practical usefulness is imparted by the sections devoted to special engines.

A CHORD FROM A VIOLIN. By Winifred Agnes Haldane. Chicago: Laird & Lee. Pp. 164. Price 50 cents.

THE MAINTENANCE OF MACADAMIZED ROADS BY THE AID OF MACHINERY. By Thomas Aitken, Assoc. M. Inst. C.E., M.C.E., Mem. San. Inst. Being selected paper No. 2894, from the Minutes of Proceedings of the Institution of Civil Engineers. (By permission of the Council.) Cupar-Fife: Printed at the Fife Herald and Journal Office, Burnside. 1895. Pp. 28.

ELECTRIC WIRING FOR THE USE OF ARCHITECTS, UNDERWRITERS, AND THE OWNERS OF BUILDINGS. By Russell Robb. New York and London: Macmillan & Company. 1896. Pp. 183. Price $2.50.

This book is a republication of a series of articles which, during the last two years, have appeared in the American Architect and Building News. Of the 175 pages of text, over 100 are devoted to an elucidation of the national code of rules for electric wiring as adopted by the National Board of Fire Underwriters and amended at New York in 1895. This gives the book a standard value for America, and goes to recommend it to the architect and builder, as well as to the electrician.

A FEW REASONS WHY THE STORAGE BATTERY TRACTION SYSTEM IS SUPERIOR TO ANY OF THE PRESENT KNOWN METHODS OF PROPULSION FOR STREET RAILWAYS. Philadelphia: Stern & Silverman. Pp. 79.

## Business and Personal.

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**References** to former articles or answers should give date of paper and page or number of question.

**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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**Special Written Information** on matters of personal rather than general interest cannot be expected without remuneration.

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**Minerals** sent for examination should be distinctly marked or labeled.

(6849) V. R. L. asks: Can a Bell telephone receiver be made to work all right on a line a mile long, with microphone transmitters, if a piece of soft iron an inch or so long is used for the magnet, so as to make the instrument very compact? Can above line be worked with one Leclanche or Law battery at each end? Would induction coils be necessary on above line with batteries, line being made of No. 12 iron wire, ends grounded, no adjacent lines to cause induction? Could a call be worked on above line with above batteries by using a relay to make a contact, and having the bells in a local circuit? What would be best to use—carbon dust or Blake transmitters? A. You need no induction coils, and can make the small telephone, of course, but at a possible sacrifice of sound-producing qualities. A single cell seems rather too little for its operation. The call could be worked on relay circuit. You can employ either transmitter. See our SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 142, 162, 163, 191, and 966, for information on the construction of telephone and calls.

(6850) A. M. H. says: Will you please inform me through the columns of your paper of a simple process by which a fine white straw hat, which has become tanned from the sun, may be bleached? A. On a small scale, with such an article as a straw hat, a bonnet, a basket, etc., the following method may be followed: The straw, having been well washed with weak soda lye, is rinsed in plenty of clean water, lightly shaken, etc.; remove superfluous moisture, and place, supported on a stick, under a large glazed earthenware pan turned upside down. A very small pipkin, capable of holding about ½ pint, is now placed on the fire, and about ½ ounce of roll brimstone placed in it. When the brimstone is all melted, a light is applied to it, so as to cause it to catch fire. The pipkin, with the inflamed sulphur, is now placed under the glazed pan in such a position as not to scorch the article to be bleached. The spaces between the pan and the table or floor on which it rests must be carefully closed with damp cloths placed around to prevent the escape of the sulphurous acid gas produced by the combustion of the sulphur. In about two hours the pan may be removed, when the straw will be found nicely bleached.

(6851) C. E. C. asks: 1. To what extent does the smallness of a dynamo interfere with its starting or building up? A. No direct answer can be given to this query. A large dynamo would be apt, owing to its large mass of core metal, to retain residual magnetism better proportionately than would a small one. 2. Is there any difference in voltage between a dynamo with electro field magnets and the same with permanent field magnets? A. Only that due to higher intensity of magnetic field. In the electromagnet higher intensity is produced. This can be compensated for by using larger permanent magnets, so that the voltage can be brought up to any desired point. 3. Will touching a steel horseshoe magnet to one pole of a dynamo or motor be sufficient to magnetize it? A. No. Pass a strong electric current through the winding.

(6852) J. J. B. says: Will you please send through the columns of SCIENTIFIC AMERICAN receipt for preparation for blackboards in school house? A. Take ½ pound logwood and sufficient boiling water to cover it; allow it to stand for twenty-four hours. Strain, and apply the solution, boiling, if possible, twice, allowing the board to dry in the interval. Then dissolve ¼ pound of copperas in about 1 pint of boiling water, and apply it boiling, once or twice, according to the degree of blackness obtained. Before using it, rub it over well with rushes, straw, ferns, or shoemakers' heel ball. It may be a little difficult to rub the chalk off at first, but after a fortnight's use that will disappear. Use unprepared chalk, which writes well. 2. Place ¼ pound of lampblack on a flat piece of tin or iron on a fire till it becomes red, take it off and leave it until sufficiently cool, when it must be crushed with the blade of a knife on a flat board quite fine; then get ½ pint of spirits of turpentine, mix both together and apply the mixture with a size brush. If the board is new, it would be well to give it one or two coats of lampblack—not burnt, but mixed with boiled oil—adding ½ pound of patent driers. After the board is thoroughly dried, apply the burnt lampblack and turpentine. The preparation must be laid on quickly.

(6853) W. E. W. asks: How many cells of dry battery would be necessary to run the motor described in SUPPLEMENT, No. 641? Would a soft iron core do for the field magnet instead of the Russia iron strips? A. Dry batteries are not adapted for running motors. Ten cells would run it, but would soon polarize. A soft iron core will answer as well or better than the barrel hoop one.

(6854) C. C. P. says: You would oblige me very much if you would answer through Notes and Queries how to caseharden iron. A. Casehardening, to be quickly performed, is done by the use of prussiate of potash. This is powdered and spread upon the surface of the piece of iron to be hardened, after the iron is heated to a bright red. It almost instantly fluxes or flows over the surface, and when the iron is cooled to a dull red it is plunged into cold water. Some prefer a mixture of prussiate of potash 3 parts, sal ammoniac 1 part; or prussiate 1 part, sal ammoniac 2 parts, and finely powdered bone dust (unburned) 2 parts. The application is the same in each case. Proper casehardening, when a deep coating of steel is desired, is done by packing the article to be hardened in an iron box with horn, hoof, bone dust, shreds of leather or rawhide, or either of these, and heating to a red heat for from one to three hours, then plunged in water.

(6855) A. B. B. asks: What size wire would be necessary to build a private telephone line about 50 miles in length out in the Rocky Mountains. Would the ordinary Bell set do? How many batteries would be necessary? How would you ring the stations? Would the magneto do it, and any other data that I have forgotten to ask for that would be necessary? A. Special telephone line wire is often used, but any telegraph wire will answer. You will require a microphone transmitter and four or five cells of battery. A good magneto would do for the ringing up. There are many details to be considered. For information on the construction of simple electric telephones, call bells, etc., see our SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 142, 162, 163, 191 and 966.

(6856) W. H. P. writes: Dealers in draughting materials are advertising a positive, black process paper, with the developer added to the sensitive coating, so that the print is developed and fixed by simply washing in water. Can you give any formulæ for the preparation of paper of this kind? A. Our SUPPLEMENT, Nos. 584 and 679, contains valuable articles on process paper, to which we refer you for an answer to your queries.

(6857) J. D. says: Please give me some simple remedy in your newspaper for hair that is turning gray. Something that will stand its color for awhile. A. Where, from some personal idiosyncrasy, the color of the hair has disappeared and cannot be restored, a dye may be considered necessary, the following will be of service; but the nitrate of silver dyes should be avoided, and the use of any dye for prolonged time is detrimental to the hair.

1. Brown:

| | |
|---|---|
| Walnut skins beaten to a pulp | 4 oz. |
| Rectified spirit | 16 " |

The above is perfectly innocent in its character. The following is original, and non-injurious:

2. Black:

| | |
|---|---|
| Sulphate of iron | 10 grn. |
| Glycerine | 1 oz. |
| Water | 1 pt. |

The hair must be thoroughly washed with this, dried, and brushed once daily for three days; then the following should be applied on a small tooth comb, but it should not be allowed to touch the skin if the other preparation has done so, as a temporary stain would result.

3. Gallic acid ..... 4 grn.
Tannic acid ..... 4 "
Water ..... 1½ oz.

After the first application of formula 2, the hair should be allowed to dry, and then be brushed. Subsequently, both formulæ may be used once daily at an interval of an hour or so, until a black color is produced.

(6858) P. T. says: Will you please tell me in your valuable paper how to mount albumen prints on glass without the use of a paddle, not leaving air bubbles or without showing streaks of the adhesive? And what is the adhesive made of? A. First coat the glass with dammar varnish or else with Canada balsam mixed with an equal volume of oil of turpentine, and let it dry until it is very sticky, which takes half a day or more. The printed paper to be transferred should be well soaked in soft water and carefully laid upon the prepared glass, after removing surplus water with blotting paper, and pressed upon it, so that no air bubbles or drops of water are seen underneath. This should dry a whole day before it is touched; then with wetted fingers begin to rub off the paper at the back. If this be skillfully done, almost the whole of the paper can be removed, leaving simply the ink upon the varnish. When the paper has been removed, another coat of varnish will serve to make the whole more transparent.

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### TO INVENTORS.

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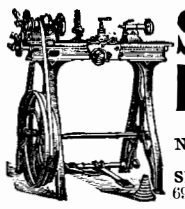

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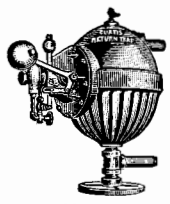

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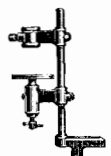

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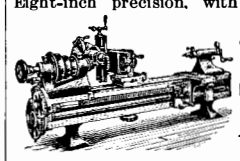

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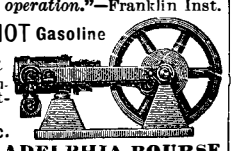

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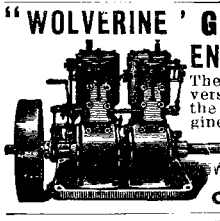

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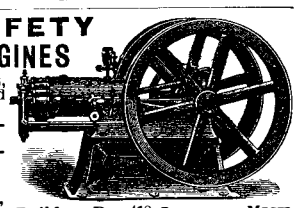

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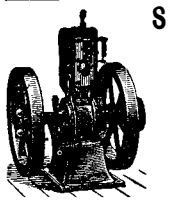

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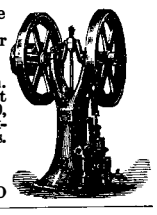

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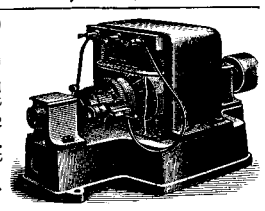

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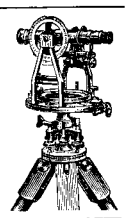

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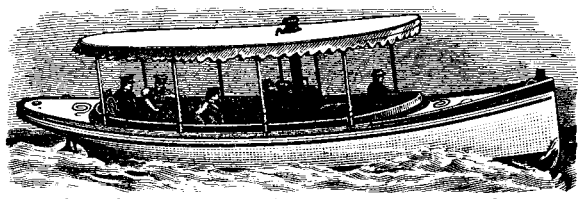

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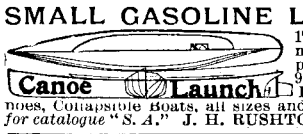


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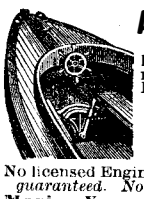

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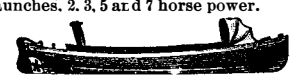

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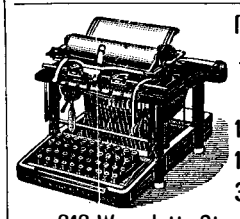

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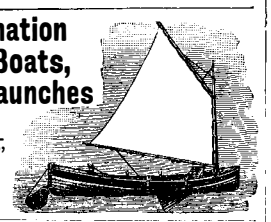

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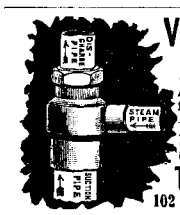

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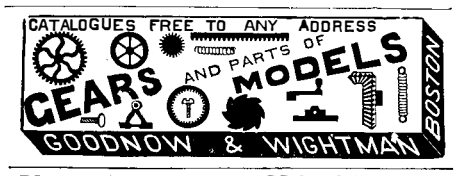


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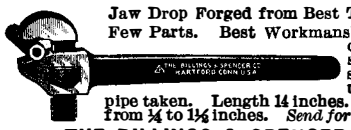

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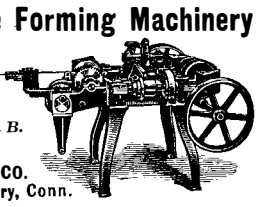

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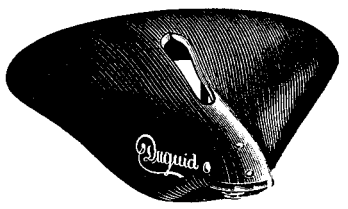


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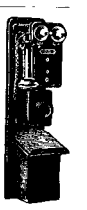

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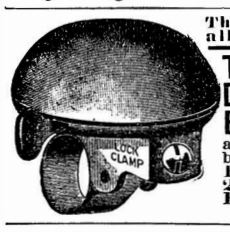

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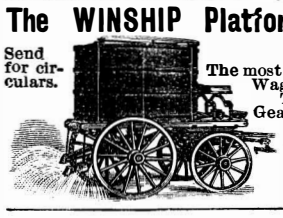

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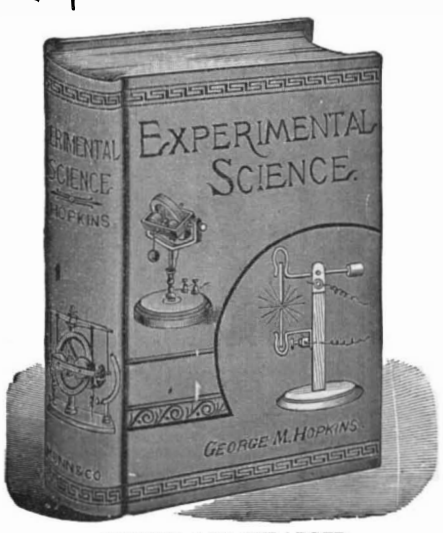


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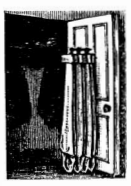

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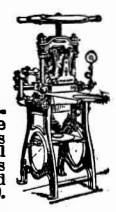

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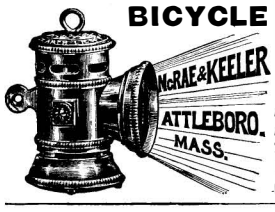


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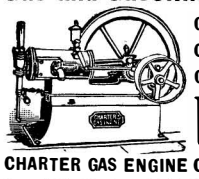

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